Identification of actors' objectives and roles in landscape redesign: a case study in the Hoeksche Waard

Name student: Renée van Dis

Period: September 2013 – July 2014

Farming Systems Ecology Group

Droevendaalsesteeg 1 – 6708 PB Wageningen - The Netherlands

WAGENINGEN UNIVERSITY
WAGENINGEN UR

Developing land use scenarios using a bottom-up approach: a multidimensional case study in the Hoeksche Waard

Master thesis for the chair group Farming Systems Ecology
submitted in fulfilment of the degree of the Master in Organic Agriculture

Major MSc thesis Organic Agriculture

Name student: Renée van Dis

Registration number student: 910405185040

Credits: 36 ECTS

Course code: FSE-80436

Period: September 2013 – July 2014

Supervisor(s): dr. ir. WAH (Walter) Rossing
Farming Systems Ecology

dr. ir. W (Willemien) Geertsema
Crop Systems Analysis

Professor/Examiner: Dr. Ir. EA (Egbert) Lantinga
Farming Systems Ecology

Preface

This study was carried out as part of the Master program Organic Agriculture at the Farming Systems Ecology chair group. I would like to take this opportunity to thank my supervisors Walter Rossing and Willemien Geertsema for their support and encouragement during the course of this thesis.

My initial research plan included proposing alternative landscapes for the Hoeksche Waard. However due to unexpected circumstances, my research plan had to be restructured and thus alternative landscapes will be proposed in a continuing research thesis. I restructured my thesis by providing more in depth qualitative research on landscape redesign. At first, this was quite challenging for me, however, my supervisors provided me with valuable feedback and guided me in completing this task in due time.

I am also very grateful for the cooperation and enthusiasm of the participating actors from the Hoeksche Waard in my research. Discussing issues about the Hoeksche Waard with the actors was a very valuable and an inspiring experience for me. They took ample time to answer my questions, they provided me with valuable information and came up with many other aspects themselves besides my survey questions.

I would like to thank the experts who participated in the survey on Multi Criteria Decision Making, which was not an easy task.

Lastly, I would like to thank my family, friends and fellow students who supported me. Especially at the times I faced difficulties, you were of great support.

Renée van Dis

Summary

In the second half of the 20th century, biodiversity in the Netherlands decreased drastically and protection was not seen as a responsibility of farmers (Ministerie van Landbouw Natuurbeheer en Visserij 2002; van Puijenbroek *et al.* 2006). Nowadays an increasing number of farmers are broadening their focus towards an integration of agriculture and nature conservation (Ministerie van Landbouw Natuurbeheer en Visserij 2002). Currently there is an increase in demand for multiple ecosystem services, while there is a decrease in the provision, resulting in scarcity of land (O'Farrell and Anderson 2010; Sandhu *et al.* 2012). There is a need to develop landscape alternatives taking into account the variety of demands for ecosystem services of the diverse actors involved within a landscape. The future of landscapes is at stake which depends on the cooperation among and perspectives of actors towards landscape redesign. Moreover due to changes in CAP farmers are 'forced' to increase their involvement in nature conservation, by managing Ecological Focus Areas. A holistic view on the landscape is needed.

An example of a landscape where there is an imbalance in demands by actors and provision by the landscape of ecosystem services, is the Hoeksche Waard. Hence, this landscape is used as a case study area for this thesis research. The purpose of this study was to identify and discuss actors' opinions, desires and demands for ecosystem services in the Hoeksche Waard. The study objective was to propose ways to identify actors, to make inventory of appreciated and concerning landscape aspects of the current and future landscape in the Hoeksche Waard, as well as to quantify the public and private benefits of actors' demands and desires for ecosystem services. The results form an important step for generating landscape alternatives in continuing research.

The research consists of three components of analysis. In component 1 the major actors involved in the Hoeksche Waard are identified. The power/influence and interests of the main actors are identified within the landscape regarding three main domains in the Hoeksche Waard: agriculture, nature conservation and recreation. The main actors were invited to partake in an interview to identify actors' demands and desires for ecosystem services. This is outlined in component 2. Relevant statements mentioned in these interviews are categorised. The major statements regarding ecosystem services are translated into a set of objectives. The objectives indicate what landscape aspects in the Hoeksche Waard to optimise in landscape redesign. However, the objectives need a translation into measurable scientific indicators. This translation is done by the use of a Multi Criteria Decision Making (MCDM) method. In the thesis research of Pim van der Horst (in preparation) a set of seven measurable ecological indicators are identified. Seven experts were asked to assess the strength of association between each indicator and each objective. Moreover the experts had to indicate the contribution of each indicator regarding non-market and market benefits.

The actor identification in this study showed the large variety of actors involved in the Hoeksche Waard. Moreover the actor analyses suggested on cooperation of actors within each of these the domains: agriculture, recreation and nature conservation. Various aspects regarding positive landscape traits and concerns on landscape traits were mentioned in the interviews and were used to establish a set of 9 objectives: what do the actors want to optimise in landscape redesign? The translation of the 9 main actors' objectives into the set of measurable ecological indicators for the Hoeksche Waard forms important input for modelling landscape alternatives. The MCDM approach showed that not all objectives are equally represented by the set of indicators. However, the

contribution of the objectives to the non-market and market benefits, as based on the indicators, is quite equally divided.

The development of the alternative landscapes will be done in another thesis research. Modelled Landscape alternatives will be based on implemented landscape indicators. One can optimise on these indicators to generate different landscape alternatives. By implementing the contribution of each indicator towards non-market and market benefits, generated landscape alternatives can be assessed regarding trade-offs given based on non-market (public) and market (private) benefits. Moreover, the division in non-market and market benefits enables to recommend on policy measures to encourage land use change, when alternative landscape are established.

For future research into identification of actors' objectives and roles in landscape redesign it is recommended to get more feedback from the actors on the data. All participating actors should be able to give feedback on the actor matrices and on the established set of objectives. Moreover, they should be involved in discussing developed alternative landscapes. Embedding actors in validation can enable realistic outcomes of alternative landscapes while limiting conflicts.

List of Figures and Tables

Acronyms and Abbreviations

CAP	Common Agricultural Policy
EFA	Ecological Focus Area
HW	Hoeksche Waard
HWL	Hoeksche Waards Landschap
H-WODKA	Hoeksche Waard Op De Kaart
LTO	Land- en Tuinbouw Organisatie
M	Market
MCDM	Multi Criteria Decision Making
MAUT	Multi Attribute Utility Theory
NM	Non Market
NRM	Natural Resource Management
OECD	Organization for Economic Co-operation and Development
R&D	Research & Development
SOHW	Samenwerking Orgaan Hoeksche Waard
WBE	Wildbeheereenheid

Table of Contents

1. Introduction

1.1 Background

In the second half of the 20th century production was the major concern in agriculture and little attention was given to nature conservation. Biodiversity decreased and protection was not seen as a responsibility of farmers (Ministerie van Landbouw Natuurbeheer en Visserij 2002; van Puijenbroek *et al.* 2006). Nowadays an increasing number of farmers are broadening their focus towards an integration of agriculture and nature conservation (Ministerie van Landbouw Natuurbeheer en Visserij 2002). Meaning landscape management plays an increasing role in agriculture. At the same time, an increase in biodiversity has beneficial impacts on agriculture, by for instance natural pest suppression, increase in soil fauna etc. (van Alebeek *et al.* 2007). Yet, not only farmers, but also society benefits from the landscape. "The benefits of nature to households, communities, and economies" (Boyd and Banzhaf 2007) are called ecosystem services. Ecosystem services make human life possible as well as it increases human well-being (Díaz *et al.* 2005). In this thesis study the following ecosystem services are distinguished (Fisher *et al.* 2009):

- Supporting – necessary for the production of other ecosystems e.g. nutrient cycling;
- Provisioning – products from ecosystems;
- Regulating – regulation ecological processes e.g. carbon sequestration;
- Cultural – e.g. recreation.

The demand for multiple ecosystem services is increasing (O'Farrell and Anderson 2010). In contrast, currently there is a large decline in the provision, despite the crucial dependency of humans on ecosystem services (Sandhu *et al.* 2012). According to Bennett *et al.* (2009) this decline is due to urbanisation of humanity (habitat loss). The large demand for multiple ecosystem services in combination with a decline in provision results in scarcity of land. Since humans depend on ecosystem services and have different demands and desires, actors' involvement on landscape level is essential (Reed *et al.* 2009; Fagerholm *et al.* 2012). As society's demand for ecosystem services seems to change over time (Antrop 2005), an approach is required to evaluate demands of actors for ecosystem services and land use. In this kind of approach different desires of actors and spatial levels should be taken into consideration.

In order to protect unique landscapes in the Netherlands against agricultural intensification and urban development, and thereby keep the ecosystem services intact, the Dutch national government identified 20 national landscapes. The goal is to protect and manage specific landscape characteristics of the different areas (Janssen *et al.* 2007). In a national landscape the domains of amenity (recreation), agricultural production and nature conservation are integrated, implying there is room for development of villages, recreational attractions, businesses etcetera as long as it fits within the context of the landscape (HWL N.D.). Recently, however, the national government of the Netherlands increased the decentralisation of nature and landscape policies (Haasnoot 2013). Conservation and management of landscape and ecosystems is now mainly performed on regional or local level (Evers 2012). Moreover the governmental funding was drastically cut (Nieuwenhuizen *et al.* 2013). An advantage is, though, that provinces get more opportunities to cooperate with local society (van Arkel 2012). A strategy should be developed how to manage landscapes without the investment of the national governments. Who feels responsible or who is willing to invest in

landscape conservation? This implies that besides ecological factors, social and economic factors play an important role in landscape redesign.

Despite the previously mentioned current issues, several scientists indicate that the protection of many ecosystem services is poorly prioritised. They stress that understanding of ecosystem services, from an ecological point of view, is limited while they are crucial for human beings' functioning. Moreover it is outlined that ecosystem services get too little attention at policy level since their economic values are not fully implemented in commercial markets. Management plans for ecosystem services should be designed, as world population (and thereby demand for these services) is increasing (Costanza *et al.* 1997; Kremen 2005; Chan *et al.* 2006; Luck *et al.* 2009; Sandhu *et al.* 2012). Thus approaching landscape management scientifically it is important to take the ecological, social and economic factors into account. An integration between science and public demand is required, as scientists have the ability to map actors' demands and desires for landscape developments and can use this knowledge to design landscape alternatives and thereby support participatory research. The local actors are the ones who are affected by environmental change and decisions made as well as they might have the power to influence outcomes (Reed *et al.* 2009). As Rapport *et al.* (1998) stated, "the landscape scale captures many values that are critical to the community, i.e. are intergenerational in nature, and places a high priority on sustaining these. This is also the appropriate scale for identifying key processes for maintaining ecosystem services".

Ecological Focus Areas

Due to changes in the European Common Agricultural Policies (CAP) farmers get an active role in fostering biodiversity and sustainable farm management strategies in agro-ecosystems. To benefit from European agricultural subsidies farmers have to cope with so called 'greening' measures in which they have to allocate 5% of their agricultural fields into ecological focus areas (EFA) as a manager of rural landscapes (Doorn van *et al.* 2012). The CAP changes need to be taken into account when dealing with future landscape redesign and land use.

In the CAP 2014-2020 farmers are obliged to keep 3 measures to get subsidies from the direct payments. This counts for 30% of all Dutch direct payments. The three 'greening' measures are:

- Crop diversification: Farmers need to cultivate at least three different crops.
- Conservation of permanent grassland.
- 5% of farmland area need to be Ecological Focus Area (EFA).

The EU defines broadly how the EFA's should be implemented. The specific interpretation can be decided by the country itself. In the Netherlands discussion on this implementation is still going on. What are farmers allowed to consider as EFA? A balance is tried to be found for farmers not to lose productivity, but to prevent 'green washing' as well (economy vs ecology). To stimulate this balance weighing factors will be applied. If a measure is highly beneficial for biodiversity a weighing factor > 1 is applied. This farmer would need less than 5% of its farmland for EFA purposes. If a measure has only a small effect on biodiversity a weighing factor <1 is applied. In this case a farmer needs more hectares to assign as EFA. Farmers could choose for the implementation of an 'equivalent package' or separate elements. In case of the package, ditches, nitrogen-fixing crops and catch crops which are bordering managed field margins are permitted to be counted as EFA. The seperate elements are 1)

unmanaged field margins, 2) a restricted list of nitrogen-fixing crops, 3) catch crops in combination with fibre crops and 4) willow coppice.

Research approach

As Pannell (2008) stated "Many problems of environmental conservation or natural resource management require changes in land management on privately owned lands". He developed a framework for decision making about policy measures in relation to land use change. Public vs. private net benefits play a leading role in his framework. Land use change has consequences for human well-being (Reyers *et al.* 2009) and in general, a specific landscape alternative will result in different net benefits for the public (non-market) and the private (market) sector, respectively. In order to encourage land use change a proper policy measure should be implemented which takes the public and private net benefits into account (Pannell 2008).

Land use change requires potential landscape alternatives (future possible scenarios of the landscape) which should be designed and selected based on local actors' desires and demands for ecosystem services within a landscape. An example of a participatory research is the scenario approach. A Danish case study by Tress and Tress (2003) investigated possible landscape alternatives for the Danish countryside in 20 years. They developed four extreme scenarios: (1) industrial farming, (2) recreation and tourism, (3) nature conservation, and (4) residential expansion. The scenarios were visualised by the use of aerial pictures and were discussed with the involved actors (Palang *et al.* 2000; Tress and Tress 2002; Tress and Tress 2003; Shearer 2005). A different approach was used in Switzerland. In this case the first step was to interview the actors. Based on the results of the interview four landscape alternatives were designed which form the basis for public assessment (Soliva and Hunziker 2009). Current literature stresses that there is an increased demand for these kinds of bottom-up approaches in which possible landscape scenarios support actor discussion (Buchecker *et al.* 2003; Fraser *et al.* 2006; Höppner *et al.* 2007; Li 2011). In the scenario-based methods the demands and preferences of actors are only qualified, there is no quantification. As revealed in the method of Pannell (2008): when encouraging a land use change, proper policy measures should be implemented. Therefore quantification of the contribution to public (non-market) and private (market) net benefits of landscape objectives and a set of measurable landscape indicators is needed. In the current study both qualification and quantification of actors' demands and desires for ecosystem services within the landscape will be established and evaluated.

Knowledge gaps

Taking the previous sections into consideration several issues seem to occur at landscape level. First of all there is an increasing demand for ecosystem services, of which protection is insufficiently prioritised. Moreover there are many actors involved who have different demands and desires from the landscape. This means that focus lies on multi-actor issues in which actors have multiple demands from the landscape. The future of landscapes is at stake which depends on the cooperation among and perspectives of actors towards landscape redesign. Moreover due to changes in CAP farmers are 'forced' to increase their involvement in nature conservation, by managing Ecological Focus Areas. A holistic view on the landscape is needed. An overview of public demand is incomplete, as well as how to support participatory decision making in landscape management and design. In order to provide answers to the raised problems and to fill the knowledge gaps, a study is conducted

to map actors' desires and demand for ecosystem services within the landscape to support development of alternative landscapes.

Framework

In order to map actors' desires and demands for landscape ecosystem services and use the results to design landscape alternatives by using a modelling tool, a 6 step framework is developed (Figure 1). Step 1 consists of interviews in which an inventory is made of actors' objectives towards ecosystem services within the landscape (what to optimise within the landscape). The outcomes will be translated into a set of objectives regarding ecosystem services indicating the demand of the actors. In step 2 a set of measurable ecological indicators are identified and selected. This set of landscape indicators is needed to generate landscape alternatives in later steps. Step 1 and step 2 are combined in step 3 where all ecological indicators are linked to the objectives and the contribution of each indicator to market and non-market benefits will be established using a Multi Criteria Decision Making method. By using this method the actors' objectives are translated into the measurable ecological indicators. The inventory of farm data is done in step 4. Information about the current situation (e.g., yield, type of crops, gross margin) of the landscape, farms and fields of the Hoeksche Waard is needed to develop land use variants. Step 3 and step 4 come together in step 5. The public (non-market) and private (market) benefits are integrated with the use of the modelling software landscapeIMAGES. The set of measurable indicators forms the input for this modelling tool. The scores indicating the strength of association of each indicator with the actors' objectives (step 3) will be included as well as the contribution of each indicator to non-market and market benefits. One can optimise on the implemented ecological indicators to generate different landscapes. The outcome of this step is the selection of landscape alternatives based on major objectives of actors. The set of landscape alternatives provide trade-offs based on public (non-market) and private (market) benefits. This outcome is used in step 6 where proper policy measures are identified for all selected landscape alternatives. The policy measures are discussed to encourage land use changes.

The framework gives an overview of all steps to be taken to develop alternative landscapes and policy implications per landscape alternative. The highlighted steps, step 1 and step 3, are elaborated in this thesis in which the inventory of public objectives and the translation of these objectives into the contribution to non-market and market net benefits took place.

Within this study an approach taken from the field of Multi Criteria Decision Analysis is used: MCDM (step 3). The search for landscape alternatives is based on Multiple Criteria Decision Making (MCDM) (Fülöp 2005). According to Linkov and Steevens (2008) MCDA methods "utilize a decision matrix to provide a systematic analytical approach for integrating risk levels, uncertainty, and valuation, which enables evaluation and ranking of many alternatives". More specifically the Multi-Attribute Utility Theory (MAUT) is used. By using this methodology the actors' demands are given a value (quantification) for public (non-market; e.g. well-being, welfare) and private (market, financial) net benefits.

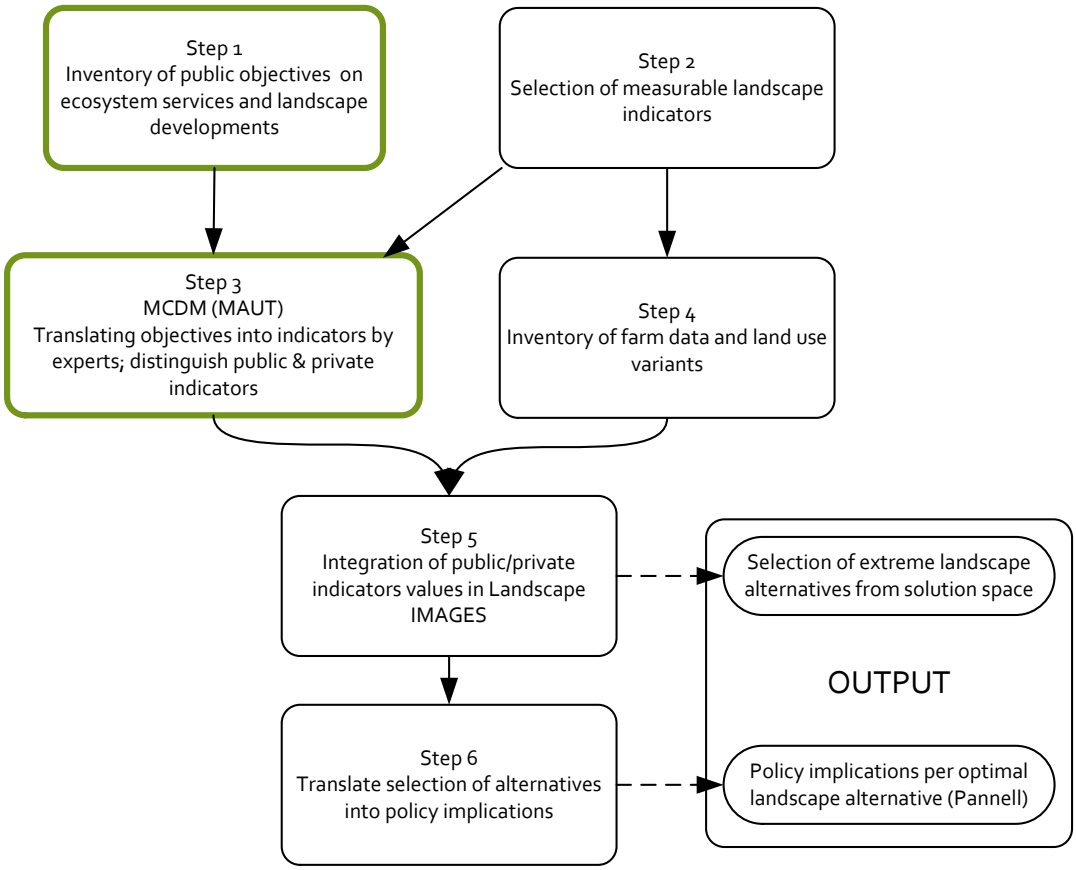


Figure 1. Research framework (within green line is done in this study)

1.2 Case study area

An example of a landscape where there is an imbalance in demands by actors and provision by the landscape of ecosystem services, is the Hoeksche Waard. Therefore it is an ideal location to assess the holistic landscape approach (Figure 1). The Hoeksche Waard was a national landscape just south of the city of Rotterdam in the Netherlands. Surrounded by the five rivers Haringvliet, Hollands Diep, Dordtsche Kil, Oude Maas and het Spui it is one of the islands of the Zuid-Holland province (Figure 2). The Hoeksche Waard was created by reclamation of land and this is where the typical green-blue veining (dikes and creeks) originates from. This veining is used by all types of plants and animals to move within the area (van Alebeek and Clevering 2005). In total the Hoeksche Waard has around 85.000 inhabitants divided over 5 municipalities. Most of the area is under agricultural production (ZKA Consultants and planners 2012). Over the years the area was subject to different spatial development plans, ranging from an airport and business park to green area. Eventually citizens demanded a final plan (city like or green area) and pleaded to give the island the status of national landscape. In 2005 Hoeksche Waard officially became a national landscape of the Netherlands. However, in 2011 this decision was reversed, because of the decentralisation of national nature and landscape policy. In order to protect the landscape and foresee in all actors' demands for ecosystem services on landscape level an inventory of actors' desires and demands is necessary. Quite a challenge when taking into account the number of actors involved in the Hoeksche Waard (HWL N.D.). The question arises who is responsible to maintain the landscape and how to integrate the domains of agriculture, nature conservation and recreation within the Hoeksche Waard.

Figure 2. Hoeksche Waard (green line) situated in Zuid-Holland

1.3 Purpose of study

The purpose of this study is to identify and discuss actors' opinions, desires and demands for ecosystem services in the Hoeksche Waard. The study objective is to propose ways to identify actors, to make inventory of appreciated and concerning landscape aspects of the current and future landscape in the Hoeksche Waard, as well as to quantify the public and private benefits of actors' objectives for ecosystem services within the landscape.

Nowadays, the province of Zuid-Holland is politically responsible for the protection and management of the national landscape Hoeksche Waard. There is a need to know where to go with the landscape considering the fact there are many actors involved and there is limited budget available. Moreover the integration of agriculture, nature conservation and recreation (experiencing) is becoming increasingly important. Knowledge about demanded and desired ecosystem services is needed to support the design of landscape alternatives in the Hoeksche Waard, as part of the dialogue among actors at different organisational levels. This knowledge can be used to design and evaluate landscape alternatives, based on actors' objectives. The overall goal of the study is to come up with Pareto optimal landscape alternatives in which major desires and perspectives by actors are taken into account, as well as policy measures which are needed to supplement interesting alternatives. This thesis focusses on step 1 and step 3 (Figure 1) of this landscape approach in which the actors' objectives are qualified and quantified and provide input from society for landscape redesign.

1.4 Research questions

The general research question of this study is:

- What are the actors' main objectives that should be taken into account landscape redesign in the Hoeksche Waard and what is their relation to an already selected set of measurable landscape indicators?

Specific research questions are:

1. Who are the main actors involved in the area and what are their interests in and influences on the domains of agriculture, nature conservation and recreation in the landscape?
2. What is the ecosystem service demand of actors in the Hoeksche Waard?
3. To what extent are actors' objectives to ecosystem services represented by a set of measurable ecological indicators?
4. How can the set of measurable landscape indicators be used to express non-market and market benefits of the landscape?

1.5 Outline of this report

This report started with an introduction, explaining the background, the context of the research and the case study area. The research objectives, questions and hypotheses have been defined. The next chapter will elaborate the methodology of this research. The study is divided into three components of analysis. The methods of each of these three components will be explained in different sections. After the methods, the results of each component are presented. Yet again, each component is explained in separate sections. The results are reflected in the following discussion chapter. The methodology and approach are discussed as well as the link to current literature and future research. At the end of the report a conclusion, reference list and appendices can be found.

2. Material and Methods

2.1 Research components

This research consists of three components of analyses to obtain answers to the research questions (Figure 3). Each component is explained more in detail in the following sections.

In component 1 the major actors involved in the Hoeksche Waard were identified as well as their power/influence and interests within the area. A variety of actors were asked in component 2 to participate in open-ended interviews in which the actors are questioned about their demands and desires for ecosystem services. The outcomes will be translated into a set of objectives in the form of statements related to ecosystem services indicating the demands of the local actors: the actor landscape objectives. These objectives indicate what landscape aspects the actors want to optimise. In order to use the objectives in a modelling tool for landscape alternatives, a translation from objectives into measurable indicators is needed. The objectives of component 2 are combined with the set of measurable ecological indicators, identified in the thesis research of Pim van der Horst (in preparation), which is done in component 3. The set of indicators are linked to the objectives. Experts are asked to assess the strength of association between each indicator and each objective, using a Multi Criteria Decision Making (MCDM) method.

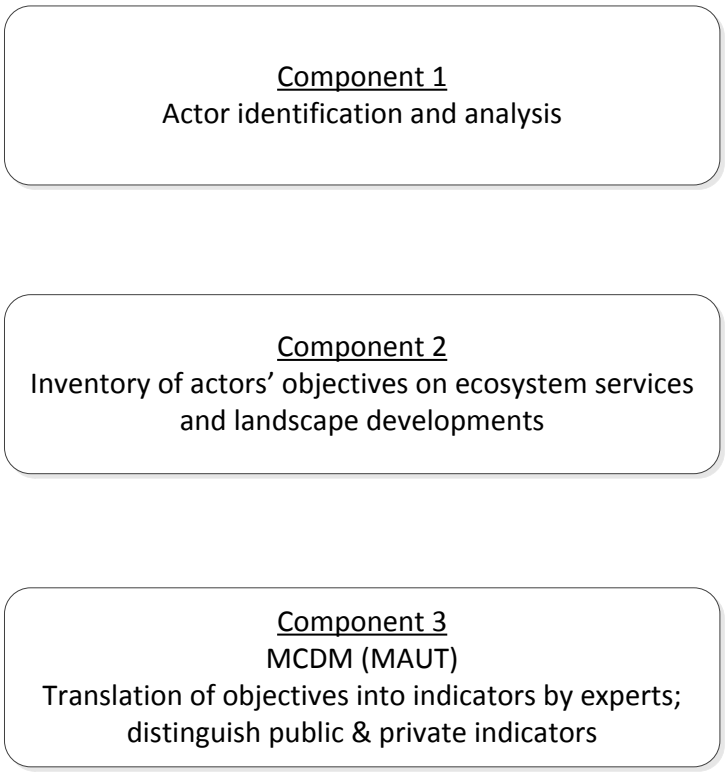


Figure 3. Components of analyses

2.2 Component 1: Actor identification and analysis

An inventory of actor groups involved in the landscape Hoeksche Waard is made, in which the groups are clustered based on the societal body they belong to. This inventory is made based on expert consultation, by research on internet and by participation in a symposium in the Hoeksche Waard, in

which many actors were present. This actor identification is used for the selection of actors to participate within the interviews of component 2 to make an inventory of actors' objectives for ecosystem services within the Hoeksche Waard.

When planning to develop landscape alternatives based on actors' objectives it is important to take into account the variety of actors with their diverse perceptions and interests. A context specific analysis of actor engagement is done in this section in order to improve future cooperation and to get a higher chance of adaptation of landscape alternatives.

The importance of taking into account actor analysis in natural resource management is emphasized in literature, e.g. MacDonald *et al.* (2013) stated "managing natural resources requires public policy makers, scientific advisors, and community actor groups to reach agreement on the activities necessary to achieve effective landscape-scale environmental outcomes". Dewulf *et al.* (2005) analysed the integration of multiple actors in management of natural resources as well. According to them "managing the interdependent uses and users of the available resources implies dealing with very different actors which all have a stake in the management of these resources. These different actors may diverge substantially in how they define what really is at stake". Reed *et al.* (2009) stress the importance of analysing who is at stake and what their stake entails in natural resource management. They state that policy and decision makers become increasingly interested in the embeddedness of actors in natural resource management and policy making, since these actors get affected by decisions and are able to influence the outcome.

Based on the actor inventory, a table providing an overview of the main participating actors, their power and their interests has been made. This table is based on information from the actors' websites and on information about the actors (groups) gained from interviews conducted with the actors (interviews are further explained in section 2.3) and. The actors in this analysis are selected, because of their participation in the interviews, their influence in landscape management in the Hoeksche Waard and/or they are influenced by decisions made in landscape management. To analyse cooperation an actor matrix is used (Figure 4). In this matrix each actor was given a value for his/her power/influence and the level of interests within each of the three main domains within the Hoeksche Waard: agriculture, nature and recreation. Thereby all actors are divided into one of the four quadrants, which provides recommendations on collaboration with the specific actor and it supports the integration of agriculture, nature and recreation with the Hoeksche Waard.

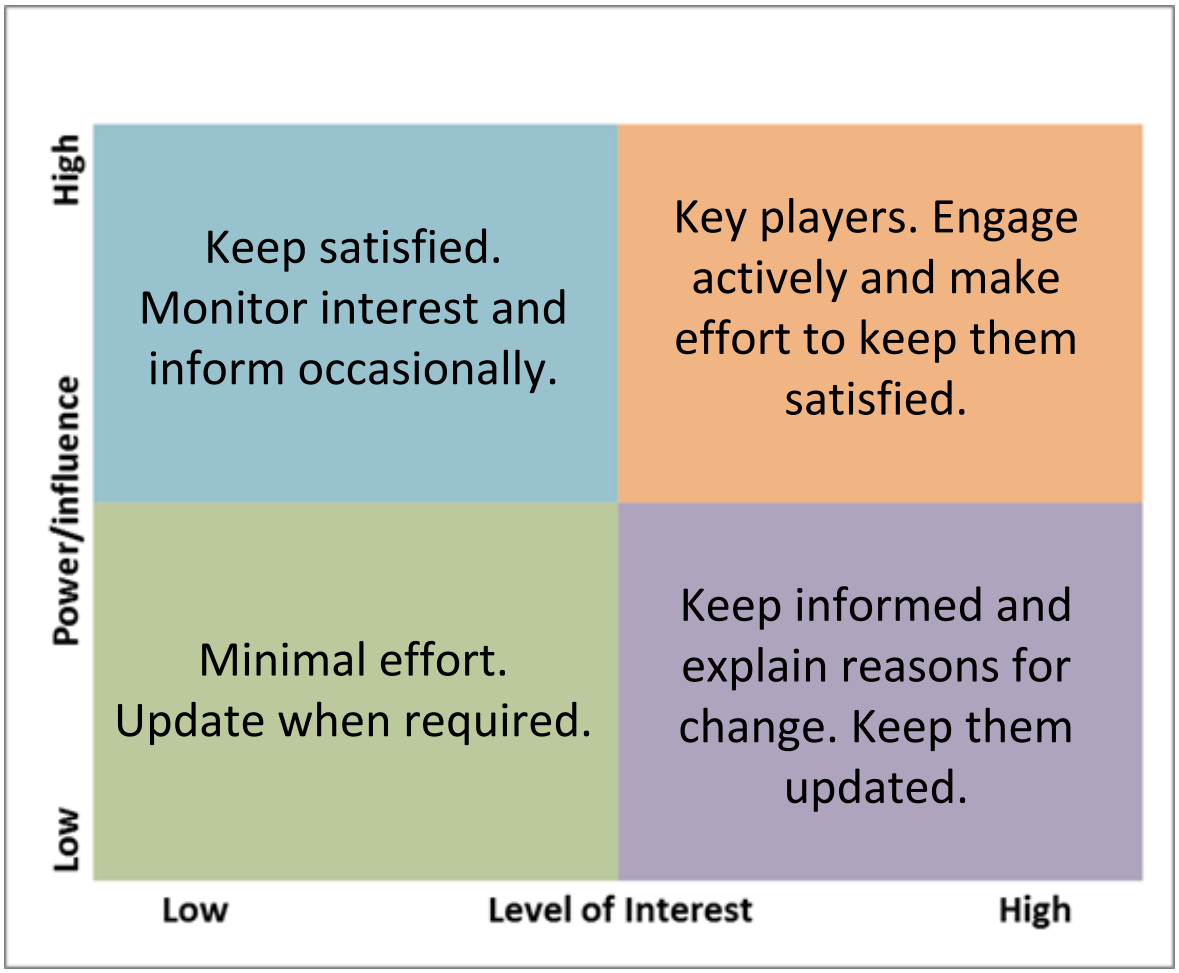


Figure 4. Actor matrix: power vs. interest.
Based on: Dutta and Burgess (2003); BiodivERsA (2013); Requirements Techniques (N.D.)

Short clarifications are given to explain the given values for interest and power/influence of each actor. The level of interest for each actor varies per domain according to the specific focus of the actor (group). The values given for interests are based on the main focus points of the actors: what do they want in the landscape? Determining the power/influence is complex and varies among the three domains. To be better able to define this level, the sources of power/influence of the actors are subdivided into 'instruments' (Reed *et al.* 2009) which influences the level of power. The five instruments used in this analysis are: (1) property, (2) policies (governmental power), (3) organisation&network, (4) resources and (5) civic support. The division of the five power instruments gave a proper basis for the values given to the level of power/influence of all actors. With the use of '+' the relative level of the instrument of each actor is indicated, ranging from +++, ++ to + (Reed *et al.* 2009). E.g. most farmers own their land, which is considered a strong power instrument. Though, they need to overcome policies and legislation to use their property as how they want to (building, fertilizer use etc.).

2.3 Component 2: Inventory of actors' objectives on ecosystem services

Interviews

This component of the research focussed on the inventory of public objectives in the form of statements about desired and demanded ecosystem services in the landscape of the Hoeksche Waard, using a qualitative method.

To map and understand the desires and interests of the diverse actors in the Hoeksche Waard interviews were conducted among them. The outcome gives an indication about the desired and demanded ecosystem services in the landscape, translated into 9 objectives: What does the public want within the landscape? As the goal is to seek opinions and perceptions it has been decided to conduct open-ended interviews, which is a useful method to gain in-depth insights (Kumar 2011; MacDonald *et al.* 2013). A draft set of questions was formulated based on literature (e.g. Hall *et al.* (2004)) and was discussed with an expert in participatory landscape assessment. As most actors were not familiar with the term 'ecosystem service', this concept was explained to the participant before the interview started. Because of limited knowledge by the actors on ecosystem services, the term ecosystem service was not used in the interview questions. Instead questions were asked about appreciated, desired and concerning aspects of the landscape. Moreover, to provoke actors to mention (desired) functions within the landscape the survey included questions related to environmental, economic and social aspects of the landscape. These questions were rather generally formulated in order to guide the interviewee without steering too much. To provoke thoughts and bring out new ideas, some questions were asked several times in different ways. If necessary, guiding questions like 'Why do you think this?', 'Can you explain more about the ecological background of this topic?' or 'Can you explain?' were asked. The basic set of interview question can be found in Appendix III.

To get in contact with the appropriate individuals of as many actor groups as possible (from actor identification in component 1) experts were consulted another time, as well as personal contacts were used (e.g. contacts from symposium). In addition, after the interviews had started, by the snowball effect I got contact information of other actors; already participating actors helped me with getting new contacts in order to obtain a large variety of participants. In total 27 actors, from a representative selection of actor categories (e.g. tourism, nature conservation, policy, agriculture) and specific actor groups (e.g. HWL, Rietgors, VVV), were invited to partake. However, all participants were associated to more than one group. This means that all participants were influenced by several interests. Hence, the interviewee was asked to answer the questions from an individual point of view without necessarily representing his/her main actor group. As a consequence, an exact actor analysis cannot be made.

Of the 27, 21 actors gave a positive response and participated in the survey (Appendix I). The interviews took 45 to 75 minutes. The interviews were semi-structured, meaning a basic set of questions was asked, though there was ample room for interaction. The interviews seemed rather like conversations. In this way participants were able to focus on the themes and aspects which they considered important, resulting in a large variety of aspects addressed which were actors' desires and concerns. Actors' need of covering these topics and the desire to participate in this interview to address their interests and concerns in the Hoeksche Waard was notable. If the interview would be more structured it would have been better possible to analyse the different opinions and interests of various actor groups more accurately. Nonetheless, in the semi-structured approach all topics of the

set of interview questions were covered and a broad range of aspects were discussed, where the interviewer took a guiding role.

Analysis

The analysis of the conducted interviews consisted of three sub steps: transcribing the interviews, text analysis and categorisation and the translation into objectives. Out of the 21 interviews, 20 of the interviews were conducted in the Hoeksche Waard and were recorded (for which participants gave permission). The 21st interview was done by telephone and is therefore not recorded. The recorded interviews were transcribed completely (in total 180 pages), without a preliminary selection of usable topics. Selective transcribing would have been less objective, as the importance (civil support) of a mentioned aspect could only be determined after conducting all interviews. Words like 'uhm', laughter and silences were kept out of the transcriptions.

Text analysis started after all interviews had been conducted and transcribed. Statements in the transcriptions were highlighted concerning desires and demands of local actors for ecosystem services in the landscape. To specify, three categories were used for this selection. The three categories are subdivided into numerous landscape elements (Table 1). The elements of the first two categories (first two columns) include the actors' appreciations and concerns on landscape traits regarding the composition and configuration of the current and future landscape. A third category was created to include other points mentioned not related to desires, but that show important landscape objectives which can eventually be used to evaluate a landscape redesign.

In total 580 statements were highlighted. Each statement was subdivided into one of the categories and to a specific element within each category. Each category is processed into a diagram. A bar in the diagram illustrates an element. The length of each bar represents how many different actors mentioned this topic (regardless whether an actor mentioned the topic several times or only once).

After categorisation, the most important elements and their statements were selected which are needed in component 3 to be linked to the set of measurable ecological indicators. Important elements include those statements having a direct relation to ecosystem services and to the composition and configuration of the landscape. In addition they needed to be mentioned by a large variety of actors. All statements of each selected element were summarised into one or two objectives. 25 objectives remained and subsequent steps were taken to reduce a the final list 9 objectives. The list of objectives was shorted by checking the ability to link the objective to an ecological indicator (section 2.4; Table 2): is this possible? Does the objective give a clear opinion or interest? The 9 remaining objectives, take into account design criteria for the Hoeksche Waard: what do the actors want to optimise within the landscape? Other, not selected, elements and statements (mainly from the third category: other aspects mentioned) include important objectives as well and can be used to evaluate the landscape.

After the set of actors' objectives had been established a feedback phase took place. All participating actors received the list of objectives, including small clarifications, by e-mail and they were allowed to respond. However, a more confronting feedback phase did not took place.

Table 1. Categories (columns) and elements to categorise the statements from the interviews in the Hoeksche Waard on current and future landscape traits

Appreciated landscape traits	Concerns on landscape traits	Other points mentioned
Physical	**Physical**	**Economic**
Trees, dikes and openness	Crop pests	Increase in house prices through landscape quality
Bird habitat	Windmill	Division costs-benefits
Field margins	Nature conservation	Financing and willingness to pay
Agriculture	Decline biodiversity	Need to market the landscape
Soil		
Creeks and Water management	**Sensory**	**Conflicting interests**
Decoration with small landscape elements	Bareness and need for embellishment	Competing claims agriculture, nature and recreation
Delta nature		Citizens versus farmers
Sensory		**Organization and conservation of the landscape**
Rest		Importance of nature conservation by human
Authenticity, history and culture		Policy and institutions influencing landscape management
		Farmer as manager of the landscape
Economic		
Agriculture as dominant land user		**Cultural services**
Tourism and recreation		Living in the landscape
Biodiversity		Amenity: recreation and tourism
Ecosystem services		**Social cohesion**
Carbon uptake		Strong regional identity
Water quality		Cooperation among actors
Biodiversity conservation		
Food supply for fauna		**Worries**
		Ageing population
		Urban or large infrastructural claims

2.4 Component 3: Linking actors' objectives to indicators using MCDM

By conducting interviews (section 2.3) 9 objectives about the actors' desired ecosystem services in the Hoeksche Waard were generated. The objectives need a translation into a set of measurable landscape indicators. The set of indicators can be implemented in the model LandscapeIMAGES. By optimising on the indicators alternative landscapes (as based on these indicators) can be generated by the model, in which actors' objectives are integrated as well. The set of measurable ecological indicators in the Hoeksche Waard is identified in the thesis report of Pim van der Horst (in preparation), which are 7 in total (Table 2). In this section the 9 objectives are not only linked to the 7 scientific indicators, but also the contribution of each indicator to market and non-market benefits was established.

Table 2. Set of measurable ecological indicators in the Hoeksche Waard
(Van der Horst, in preparation)

I1	Visibility of dikes (*distance of road or dike r with conventional, ecological or phased ecological mowing (m))*
I2	Agriculture (*total area of borders and flower strips which could have been used as agricultural area in parcel x in ha*)
I3	Spatial coherence of natural landscape elements (*dispersal capacity and the size of the largest interconnected cluster of habitats*)
I4	Diversity of animals in sown field margins (*Satoyama Index*)
I5	Length of natural banks and visibility of creeks (*area of natural banks within a range of 100 meters from a bicycle path*)
I6	Production of food crops (*net benefits of parcel x in €)*
I7	Presence of organic or biodynamic agriculture (*ha*)

The method which is used to link the objectives to each indicator is taken from the field of Multi Criteria Decision Analysis (MCDA) (Fülöp 2005; Steele *et al.* 2009). Within MCDA several methods are available. A simple method to link the set indicators to the objectives is by using MAUT, Multi Attribute Utility Theory. According to the Instructional Assessment Resources Website (2007) "MAUT creates defined criteria for choosing the best solution". By using this method dissimilar ecological indicators are brought to a common denominator. The strength of association between the 9 actors' objectives and the set of 7 indicators are assessed. Additionally the contribution of the scientific indicators to market and non-market benefits are identified.

By using MAUT (1) the relative importance of the 7 ecological indicators for the context of the Hoeksche Waard (i.e. societal input) could be compared among each other as well as to what extent they represent the 9 objectives, (2) the contribution of the indicators to market (private) and non-market (public) benefits is indicated, (3) it is assessed which market and non-market contribution the objectives express based on information given by the indicators (Linkov and Moberg 2011). The assessment of the strength of association between each indicator I_i (i=1,...,a) and each objective S_s (s=1,...,b) is done by a group of 7 experts. The experts were selected based on their expertise in the field of landscape redesign and conservation of which several had specific knowledge of the Hoeksche Waard. The experts were asked to complete a survey in which each new question showed one of the 9 objectives. Below the objective the list with 7 indicators is shown. The experts had to assess the strength of association of each indicator and the objective written above, by giving it a mark rating from 1 (weak association) to 5 (strong association). Scoring did not consider whether the

association was a positive or negative. The outcome was written as O_{is} which describes the value of indicator *i* linked with objective *s*. Schematically this looks as follows (Figure 5).

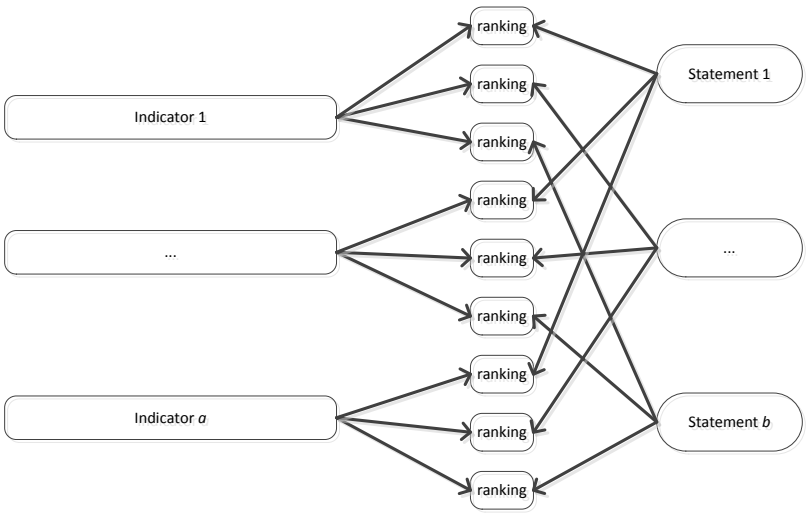


Figure 5. Linking indicators and objectives

After establishing the association between indicators and objectives, the experts were asked to divide 100 points over the set of 7 indicators, both regarding non-market benefits ($W_{NMi,}$ i=1,...,a) and market benefits (W_{mi}, i=1,...,a).

The results of the relative associations of I_i with S_s (O_{is}) of each expert were summed per indicator. This sum was multiplied with the corresponding indicator weights W_{NMi} and W_{mi} to calculate the contribution of an indicator to market and non-market benefits. The total results of all experts were summed per indicator (X_{Mi} (i=1,...,a) and X_{NMi} (i=1,...,a)). This calculation is also done for each objective (Y_{Ms} (s=1,...,b) and Y_{NMi} (s=1,...,b)) indicating the information given by the set of indicators about the contribution of each objective to market and non-market, in respect to the other objectives. In the case of the objectives, each value of O_{is} was first multiplied with the corresponding weight (W_{NMi} and W_{mi}) and these multiplications were summed for each expert per objective. Finally the total results were summed for all experts (Table 3).

Table 3. Decision matrix

	Market	Non-market	S_1	...	...	S_b	X_M	X_{NM}
I_1	W_{M1}	W_{NM1}	O_{11}	...	...	O_{1b}	$W_{M1}\sum_{s=1}^{b} O_{1s}$	$W_{NM1}\sum_{s=1}^{b} O_{1s}$
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
I_a	W_{Ma}	W_{NMa}	O_{a1}	...	...	O_{ab}	$W_{Ma}\sum_{s=1}^{b} O_{as}$	$W_{NM1}\sum_{s=1}^{b} O_{as}$
Y_M			$\sum_{i=1}^{a} W_{Mi} \times O_{i1}$	...	...	$\sum_{i=1}^{a} W_{Mi} \times O_{ib}$		
Y_{NM}			$\sum_{i=1}^{a} W_{NMi} \times O_{i1}$	...	...	$\sum_{i=1}^{a} W_{NMi} \times O_{ib}$		

Eventually four outcomes were derived: (1, 2) the weighted sum of contribution per indicator for market and non-market benefits of all respondents and (3, 4) the weighted sum of contribution of each objective for market and non-market benefits (based on information given by the indicators). These outcomes are shown in the following equations:

$$X_{Mi} = W_{Mi} \sum_{s=1}^{b} O_{is} \qquad \textbf{Eq. 1}$$

$$X_{NMi} = W_{NMi} \sum_{s=1}^{b} O_{is} \qquad \textbf{Eq. 2}$$

$$Y_{Ms} = \sum_{i=1}^{a} O_{is} \times W_{Mi} \qquad \textbf{Eq. 3}$$

$$Y_{NMs} = \sum_{i=1}^{a} O_{is} \times W_{NMi} \qquad \textbf{Eq. 4}$$

The actors' desires and demands for ecosystem services in the Hoeksche Waard were translated into the set of measurable ecological indicators. The outcomes of X_i (both X_{Mi} and X_{NMi}) indicate the relative importance of each indicator to the objectives and the contribution to non-market and market benefits. It can be used in quantitative analyses to generate landscape alternatives for the Hoeksche Waard. The sum of O_{is} for each objective indicates the representativeness of the actors' objectives by the set of indicators, according to the experts. This analyses can be used to evaluate the set of indicators and landscape alternatives generated based on the indicators. The outcomes Y_{NMs} and Y_{Ms} explain which value of market and non-market benefits the objectives express (based on information given by the indicators). The ratios of Y_{NMs} divided by (Y_{NMs} + Y_{Ms}) were calculated and presented in a diagram.

3. Results

This chapter gives an overview of the main results gained to answer the research questions. The results of each component of analyses are elaborated in separate sections.

3.1 Component 1: Actor identification and analysis

Figure 6 gives an overview of the identified actors involved in the Hoeksche Waard based on their societal body (indicated by different colours). A description of the main actors is given in Table 4**.** The main actor description explains the main focus points, interests, influences and relations with others for each actor. As this Figure and Table show there is a large variety of actors involved in the Hoeksche Waard with diverse interests within the three landscape domains of the Hoeksche Waard: agriculture, nature conservation and recreation and tourism. It will remain a challenge to integrate the three domains as cooperation of the involved actors is important. Figure 7, Figure 8 and Figure 9 show actor matrices for the three different landscape domains. Short clarifications about were the given values (interest and power/influence) of each actor are based on can be read in Table 5, Table 6 and Table 7.

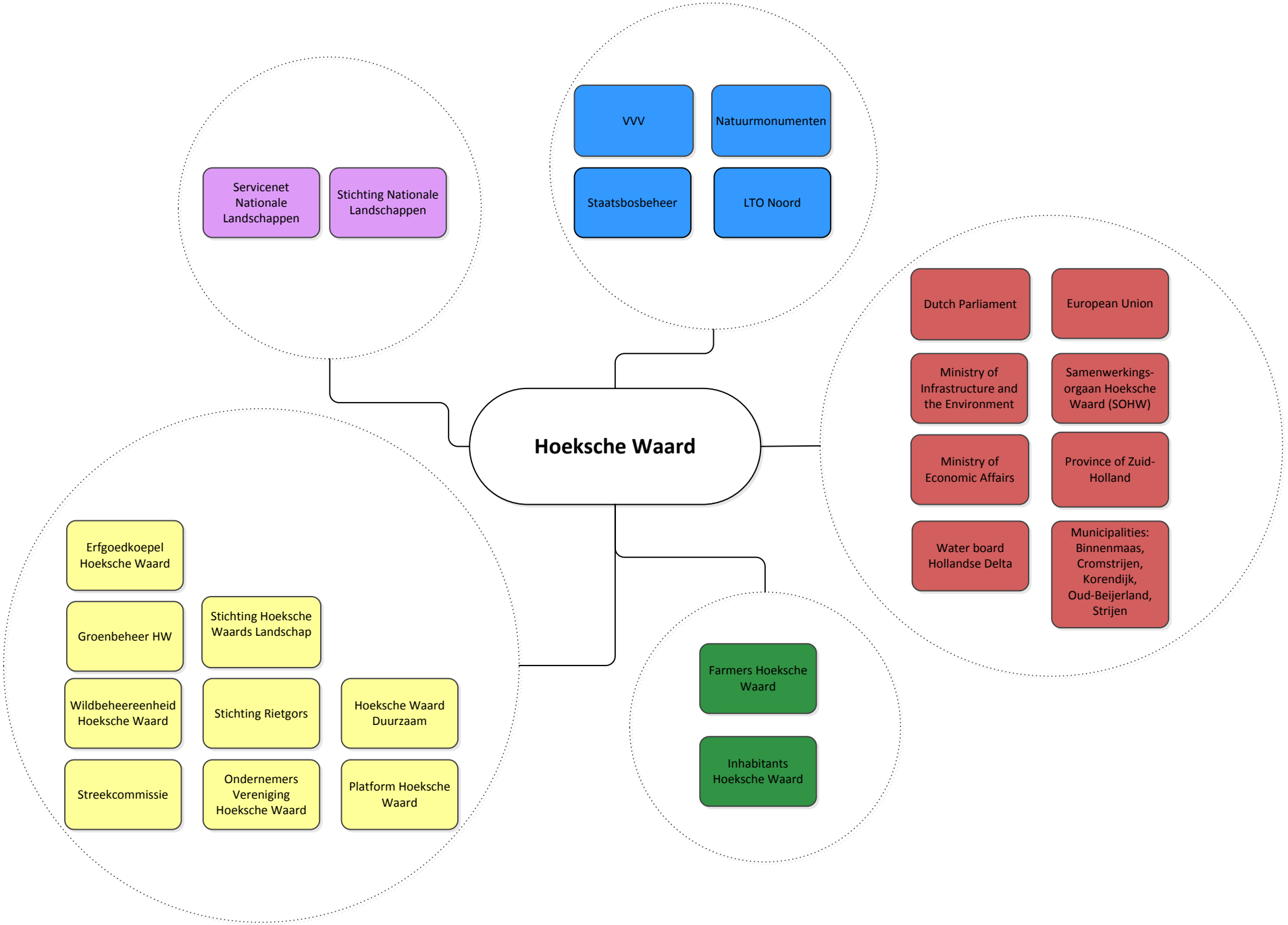


Figure 6. Actor overview Hoeksche Waard according to their societal body

(Purple=national landscape organisations, Blue=national organisations with sub-divisions in HW, Red=governmental institutions, Green=Farmers and inhabitants, Yellow=community actor groups HW)

Table 4. Main actor description

Category	Actor (group)	Description focus points	Interests – what do they want?	Influence Landscape Hoeksche Waard instrument	Relation other actors
Inhabitants	General public	Inhabit Hoeksche Waard	Pleasant and safe environment to live, work and recreate with sufficient facilities	Civic support (e.g. voting, memberships) (+)	Member of several actor groups, e.g. volunteer at HWL
Nature, culture and agricultural NGO's	Hoeksche Waards Landschap	Conservation, protection and development nature and landscape	Proper conservation of nature within this agricultural based landscape	Civic support (+++), organisation & network (++)	Good relation with other actors, first conflicts would occur with farmers
	Erfgoedkoepel Hoeksche Waard	Conservation cultural heritage within landscape	Maintenance Readability landscape history whereby focus stays on (original) agriculture	Organisation & network (++)	Good relation with other actors
	Natuurmonumenten	Protection and conservation nature areas	Increased focus on nature development and conservation	(Financial) resources (++), Civic support (+++)	Conflicting interests other organisations and farmers
Policy	Municipal governments	Govern municipalities Hoeksche Waard	Conservation landscape characteristics by policy making, increase marketing	Policies (governmental power) (+++)	In general good relations other actors as long as they motivate and do not punish
	SOHW	Umbrella organisation 5 municipalities	Conservation landscape, improve cooperation municipalities and organisations	Policies (governmental power) (++), Organisation & network (+++)	Good relations other actors – umbrella organisation
	Water Board Hollandse Delta	Protection against floods and manage surface waters	Access to high quality fresh water, spatial embedding water from an ecological/landscape point of view	Policies (governmental power) (+), Organisation & network (++)	Government, SOHW, civil organisations (like HWL)
Agriculture	Farmers	Make a living out of the agricultural sector	Access to (large) fertile soils and fresh water. Ability to develop profitable farms, without restrains by policies and nature conservation	Property (++)	Close relation with LTO, Rietgors and H-Wodka. Conflicts with Natuurmonumenten
	LTO	Representation agricultural entrepreneurs	A landscape dominated by healthy, profitable farms	Organisation & network (++)	Close relation with Rietgors, WBE and H-Wodka. Conflicts with Natuurmonumenten
Tourism and recreation	Tourist information	Development and promotion of recreation within landscape	Possibilities in landscape for recreation on daily basis and accommodation	Organisation & network (+)	Relations are fine
Foundations landscape Hoeksche Waard	Wildbeheereenheid Hoeksche Waard	Conservation wildlife Hoeksche Waard	Development and conservation of wildlife and its habitats	Organisation & network (++)	Good relations other actors. Highly represented in other organisations
	Rietgors	Profitable agriculture, within an attractive landscape. Agro-nature conservation	Development healthy and profitable farms who profit from agricultural nature conservation	Organisation & network (+++)	Work closely with LTO, H-Wodka, WBE, water board (representatives from several organisations)
	H-Wodka	Give incentives for innovation in agriculture	Healthy, profitable and innovative agricultural sector, precursor in Europe	Organisation & network (++)	Good relations, in particular, agricultural organisations. Less with nature conservationists

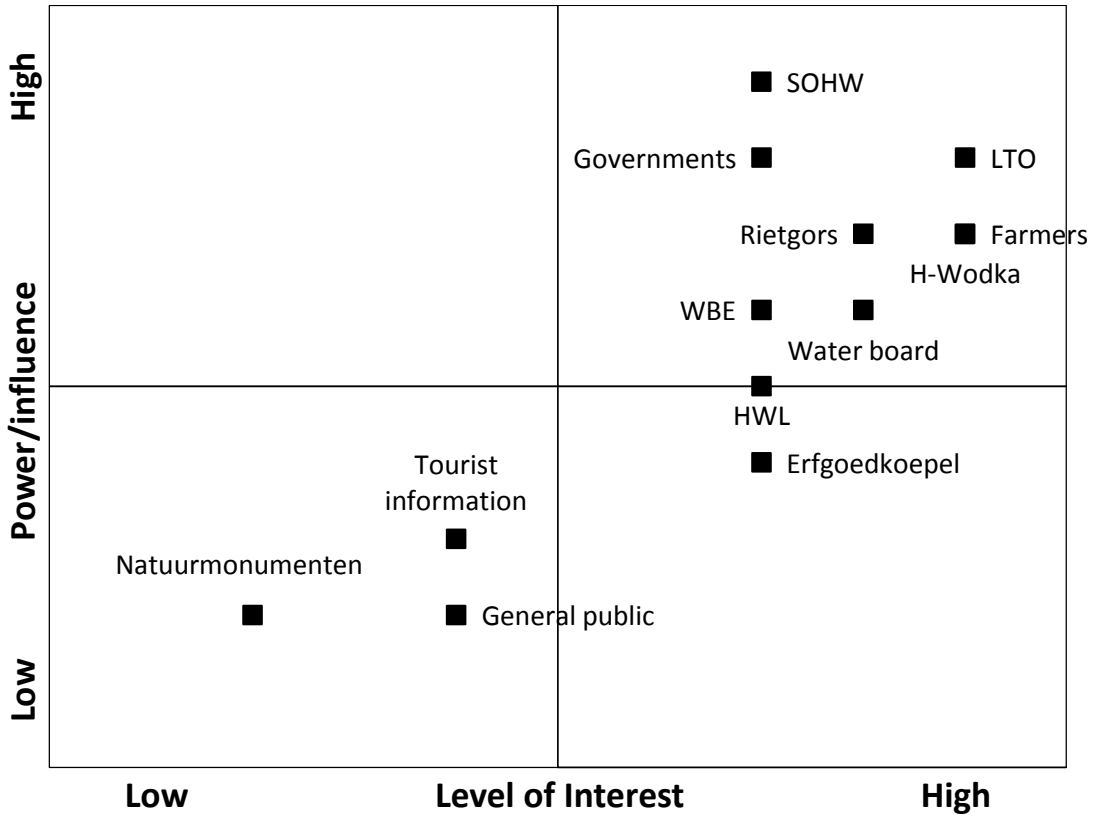


Figure 7. Level of interest and power/influence within the agricultural domain for the main actors

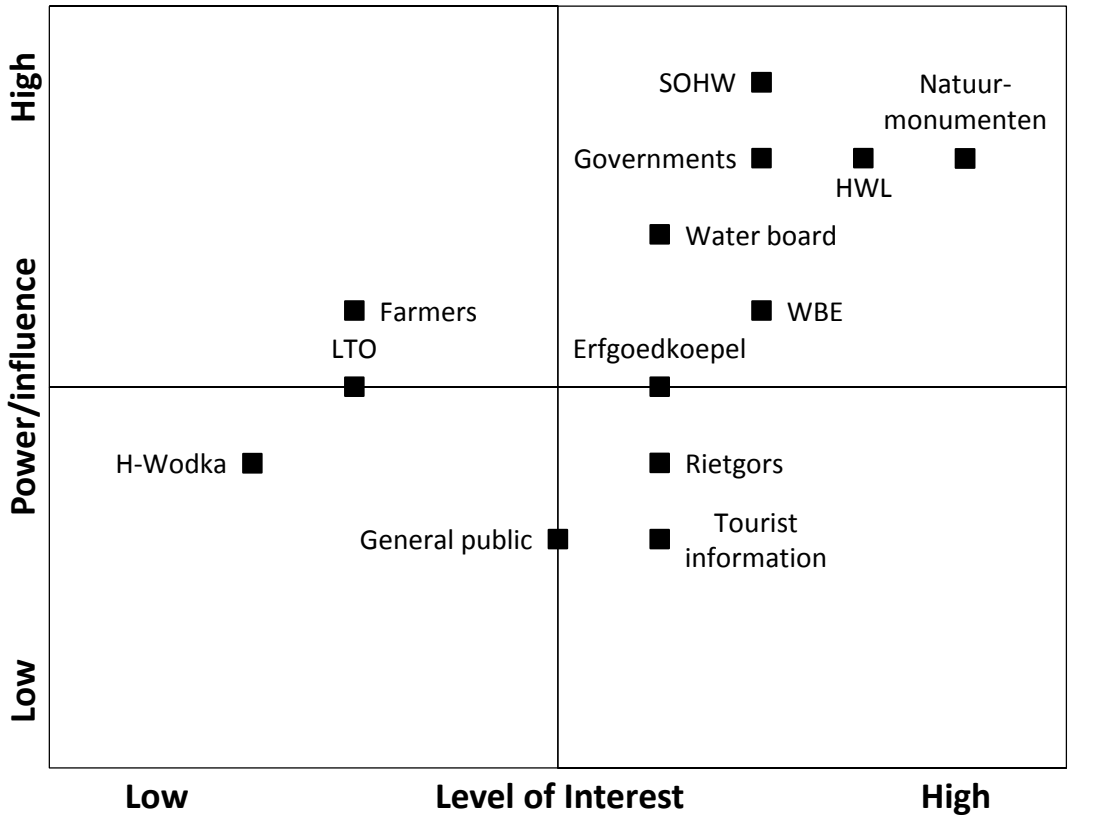


Figure 8. Level of interest and power/influence within the nature domain for the main actors

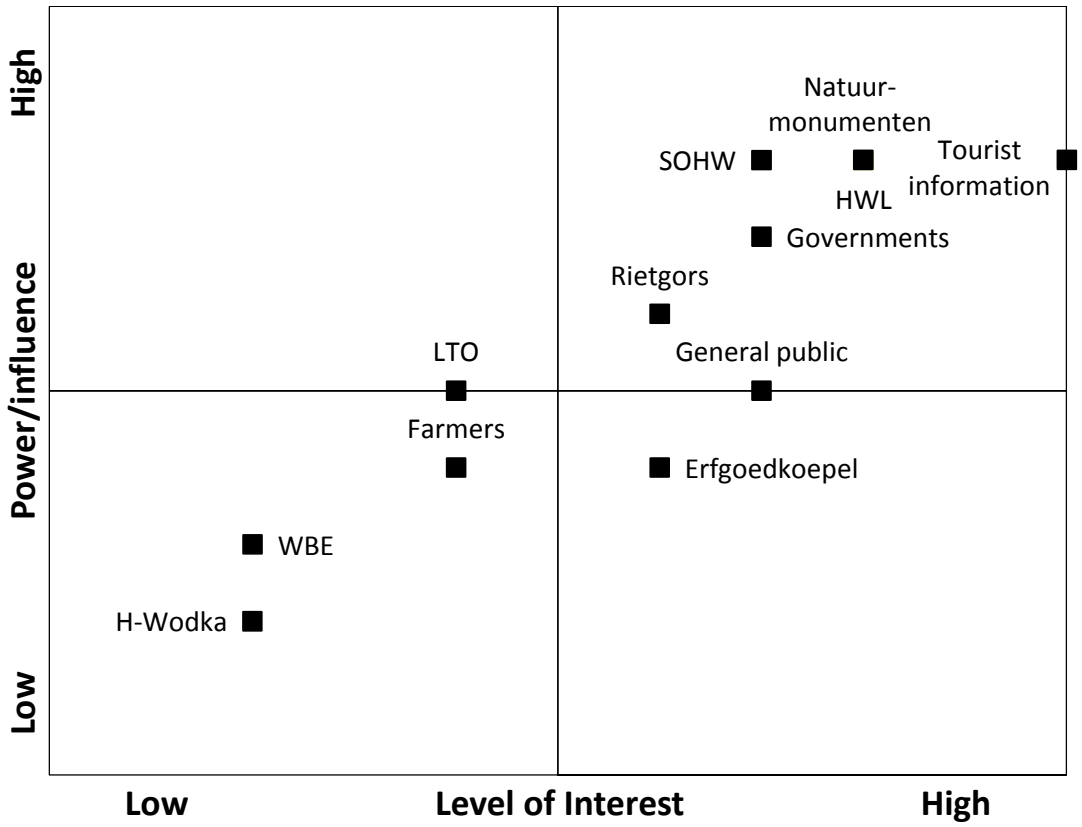


Figure 9. Level of interest and power/influence within the recreation domain for the main actors

Figure 4 in the methodology shows recommendations on how to collaborate with the actors in each of the four quadrants. As Figure 7, Figure 8 and Figure 9 indicate which actors are situated in which quadrant for each of the three landscape domains in the Hoeksche Waard, it can support future cooperation among actors. As the matrices show, within each domain most actors are divided in the 'key players' quadrant. This means that in all three domains actors should make effort to keep everyone satisfied and engaged. Probably no actor will develop itself into one dominant key player, as the social pressure of other 'key players' will be too high.

In the matrix of the agricultural domain (Figure 7) key players are the agricultural related actors: LTO, farmers, H-Wodka and Rietgors. Though, one should not neglect the power of the government who can restrict farmers by the use of policies and legislations. Local governments do have a high level of interest in agriculture, since they want to conserve the characteristics of the landscape of the Hoeksche Waard (agriculture is a dominant characteristic) and maintain the profitable and sustainable agricultural sector. In the matrix of the nature domain (Figure 8) Natuurmonumenten and HWL play an important role. Important to take into account are the farmers who have relatively high level of power/interest. As they own the land it might be their decision to make their land available for nature conservation or not. Obligatory involvement of farmers in nature conservation (like the greening measures in CAP 2014-2020) can induce resistance among farmers, which is undesirable within an agricultural dominated landscape. Many actors are involved in the recreational domain as well, as a variety of actors play a part in platform recreation and tourism coordinated by SOHW (see Table 4). They are for instance involved in the construction of a walking trial related to their own domain (e.g. walking trial on farm fields, or along historic farm buildings).

Table 5. Actor analysis agricultural domain within landscape Hoeksche Waard

Actor (group)	Interest	Explanation	Power/ Influence	Explanation
Rietgors	8	Interested in an agricultural based landscape with its combination of natural aspects, like field margins	7	Power by large network in agricultural sector
Farmers	9	Benefit from high productive agricultural landscape.	7	Owners of the productive fields, though restricted by policies
General public	4	Want to live in a safe and healthy environment, with sufficient recreation	2	Hardly any influence
Natuurmonumenten	2	Interested in natural areas, which they already have in the Hoeksche Waard	2	Low level of power in an agricultural based landscape
HWL	7	Main focus on conservation and maintenance of the landscape, including its agricultural character	5	High rate of followers in Hoeksche Waard, though based on conservation of landscape characteristics, not on intensifying agriculture
Erfgoedkoepel	7	Prefer the agricultural landscape as it originally used to be, including the creeks, ditches, trees, dikes	4	Network Hoeksche Waard on landscape characteristics, in itself not specific related to agriculture
LTO	9	Main focus on the agricultural aspects of the landscape	8	Large network within Hoeksche Waard in agriculture
Governments	7	Have to satisfy all actors active in this agricultural landscape	8	Power by implementing policies, subsidies and restrictions
SOHW	7	Umbrella organisation--> satisfy all actors. Appreciate characteristics Hoeksche Waard	9	Power by policies and relations with all active actors. Involved in many projects
WBE	7	Prefer a landscape with proper habitats for wildlife, this includes food, but also shelter etc.	6	Several different actor groups are member of WBE, though preference on a more extensive agricultural system
Tourist information	4	Interested in the recreational aspects of the landscape	3	Large network, but not related to agriculture
H-Wodka	9	Interested in improving agricultural efficiency	7	Large network. Most members are farmers as well
Water board	8	Involved in the maintenance of all surface waters, creeks, embankments etc.	6	Could restrict farmers related to water issues; it is a governmental body to control and regulate water resources

Table 6. Actor analysis nature conservation domain within landscape Hoeksche Waard

Actor (group)	Interest	Explanation	Power/ Influence	Explanation
Rietgors	6	Interested in an agricultural based landscape with its combination of natural aspects--> diverse agricultural systems	4	Power by network in agricultural sector, not that much in nature conservation
Farmers	3	Benefit from high productive and efficient agricultural landscape. Natural elements could give additional benefit to production	6	Power by property of land. Farmers are seen as 'carriers' of the landscape. Obliged to partake in nature conservation by CAP
General public	5	Want to live in a safe and healthy environment, with sufficient recreation	3	Limited influence, by membership of for instance HWL
Natuurmonumenten	9	Interested in nature conservation, which is their main focus	8	Resources to gain and manage nature areas, high rate of followers nationwide
HWL	8	Main focus on conservation and maintenance of the landscape, including its natural elements	8	High rate of followers in Hoeksche Waard on landscape conservation
Erfgoedkoepel	6	Prefer the agricultural landscape as it originally used to be, including the creeks, ditches, trees, dikes etc.	5	Network Hoeksche Waard on landscape issues, though small organisation
LTO	3	Main focus on the agricultural aspects of the landscape	5	Large network within Hoeksche Waard related to agriculture
Governments	7	Have to satisfy all actors active in the landscape	8	Power by implementing policies, subsidies and restrictions
SOHW	7	Umbrella organisation--> satisfy all actors. Appreciate characteristics Hoeksche Waard	9	Power by policies and relations with all active actors. Involved in many projects
WBE	7	Prefer a landscape with proper habitats for wildlife, this includes food, but also shelter etc.	6	Several different actor group are member of WBE
Tourist information	6	Interested in the recreational aspects of the landscape, which can be found in natural areas	3	Network and ability to integrate tourism in landscape, but not specific related to land-use issues
H-Wodka	2	Interested in improving agricultural efficiency, GPS use most efficient on large, retangular fields with limited natural elements (distraction)	4	Large network, but most members are farmers and have agricultural focus
Water board	6	Interested in the maintenance of all surface waters in the Hoeksche Waard	7	Can be of influence in the landscape by proper management of water resources and natural elements, like dikes and verges

Table 7. Actor analysis recreation domain within landscape Hoeksche Waard

Actor (group)	Interest	Explanation	Power/ Influence	Explanation
Rietgors	6	Direct involved in development of recreational routes	6	Coordinator is member of recreational platform. Active in platform recreation and tourism
Farmers	4	Some appreciate on farm recreation, but others don't. Main focus on production	4	Power by property of land, e.g. hiking route on field or pier for canoes
General public	7	Just want to live in a safe and healthy environment, with sufficient recreation	5	Influence by participation in recreational activities
Natuurmonumenten	8	Want landscape to be open for citizens to recreate. Highly involved in recreational activities (e.g. Tiengemeten)	8	Resources to gain and manage recreational activities, high rate of support nationwide. Active in platform recreation and tourism
HWL	8	Highly involved in recreation to show the landscape, its agriculture, history and natural areas	8	High rate of followers in Hoeksche Waard. Offer a lot of activities.
Erfgoedkoepel	6	Focus on cultural history of the island. Participate in recreational activities with other actors	4	Active in platform recreation and tourism
LTO	4	Main focus on the agricultural aspects of the landscape. Participate in recreational activities with other actors (e.g. hiking on farm field)	5	Large network within Hoeksche Waard related to agriculture – Active in platform recreation and tourism
Governments	7	Have to satisfy all actors active in the landscape	7	Power by implementing policies, subsidies and restrictions. Active in platform recreation and tourism
SOHW	7	Umbrella organisation--> satisfy all actors. Appreciate characteristics Hoeksche Waard	8	Power by policies and relations with all active actors. Coordination platform recreation and tourism
WBE	2	Prefer a landscape with proper habitats for wildlife. Low interest in recreation	3	Several different actors are member of WBE
Tourist information	10	Interested in the recreational aspects of the landscape	8	Network and ability to integrate tourism in landscape, but depend on willingness of Hoeksche Waard to participate
H-Wodka	2	Interested in improving agricultural efficiency	2	Large network, but most members are farmers and have agricultural focus
Water board	6	Interested in the maintenance of all surface waters in the Hoeksche Waard	6	Can be of influence in the landscape by proper management of recreational areas (e.g. creek areas, water quality)

3.2 Component 2: Inventory of actors' objectives on ecosystem services

The main goal of the interviews was to generate a set of objectives in the form of statements indicating the actors' desires and demands for ecosystem services within the landscape. In total 580 statements were selected from the interviews and subdivided over the three categories (appreciated landscape traits, concerns on landscape traits and other points mentioned) and elements (Table 1). Figure 10, Figure 11 and Figure 12 display by how many different actors mentioned each of the elements. Each figure represents one of the three categories. It is not taken into account how many times a specific actor mentions an element.

Several statements indicating appreciated landscape traits were addressed by the interviewed actors like:

"*By using field margins less pesticides are blown into the ditch*". (A4)

"*The trees along the dikes are beautiful*". (A21)

Examples of statements indicating concerns on landscape traits are:

"*When I came to live here in February, I found the landscape quite bare*". (A13)

"*I wouldn't appreciate if 100m from my house a windmill would be build. It is not pretty*". (A15)

The third category contains other landscape elements mentioned. These elements are not desires on the composition and configuration within the landscape, but are important objectives and can contribute to landscape evaluation. As Figure 6 and Table 4 show, the Hoeksche Waard has a diverse and large variety of actors involved in landscape conservation. Although they operate in close cooperation, there are many different interests. Statements brought forward are for instance:

"*One has other wishes compared to others. In this area people do not tend to defence themselves immediately. I think this is a very strong aspect of the Hoeksche Waard. In this area people keep talking, they still keep being democratic*". (A4)

"*You should cooperate on this island. Stagnation of this cooperation could be a threat*". (A24)

"*They should introduce one municipality named Hoeksche Waard, they must do this quickly*". (A17)

In general people seem quite satisfied with current landscape characteristics, like the agricultural character and the green-blue veining. As Figure 11 shows, 17 different actors mentioned agriculture (the current dominant character of the Hoeksche Waard) as an appreciated landscape trait. In addition, appreciated current landscape characteristics like trees, dikes and the openness are mentioned by 13 different actors as well. Nature conservation as mentioned as a concern within the landscape was covered by 12 different actors. Most statements within this element are about the fear of large and forced landscape changes (e.g. convert polders into nature areas). Smaller nature conservation projects, like the implementation of field margins and the developments around the creeks and its banks, are appreciated.

While most actors were not familiar with the term 'ecosystem services', they focussed mainly on visual aspects of the landscape regarding appreciated landscape aspects (Figure 11). Surprisingly, some actors came up with specific services as carbon uptake as an appreciated landscape trait and even biodiversity

from an economic point of view was mentioned. The landscape is constantly under pressure. Competing claims on ecosystem services regarding the domains of agriculture, nature conservation and recreation occur and proper organisation and cooperation of actors seems essential. In the interviews conflicting interests have been addressed, as well as that different actors should remain connected and try to seek for overlap instead of their contradictions (Figure 10):

"*The landscape is unique, one should improve and maintain this. Above all, adapt to each other and don't act too forced.*" (A4)

"*Farmers evaluated the interests related to nature conflicting to their own interest.*" (A8)

"*Some collaborations are not optimal yet."* (A10)

"We have always been able to put aside our differences and concentrate on the similarities we have. I think this makes us strong in the Hoeksche Waard." (A6)

It was remarkably how many topics were mentioned within the category 'other point mentioned' (Figure 12). Not only statements on cooperation were mentioned, but also about the role of the government (stimulating and facilitating) and finances regarding the landscape. An example of this later element is:

"*Most farmers are willing to do everything, unless it gets paid. Of course there should be compensation*." (A12)

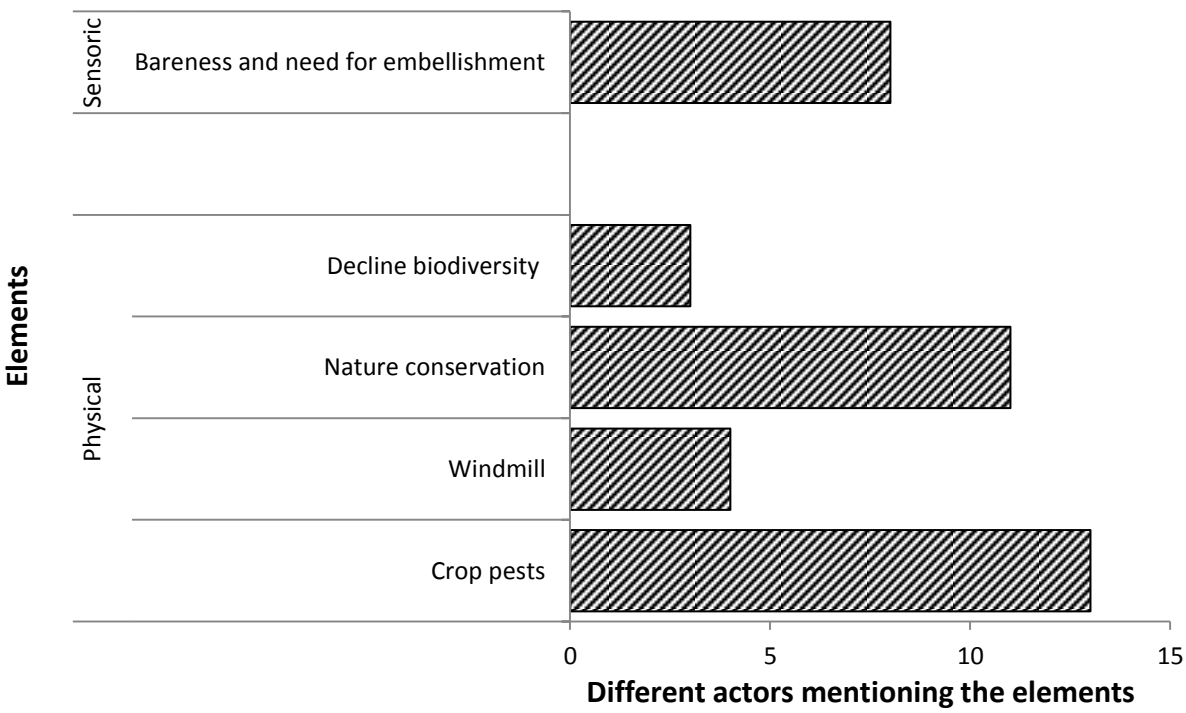


Figure 10. Number of different actors mentioning an element within the category of 'concerns on landscape traits'

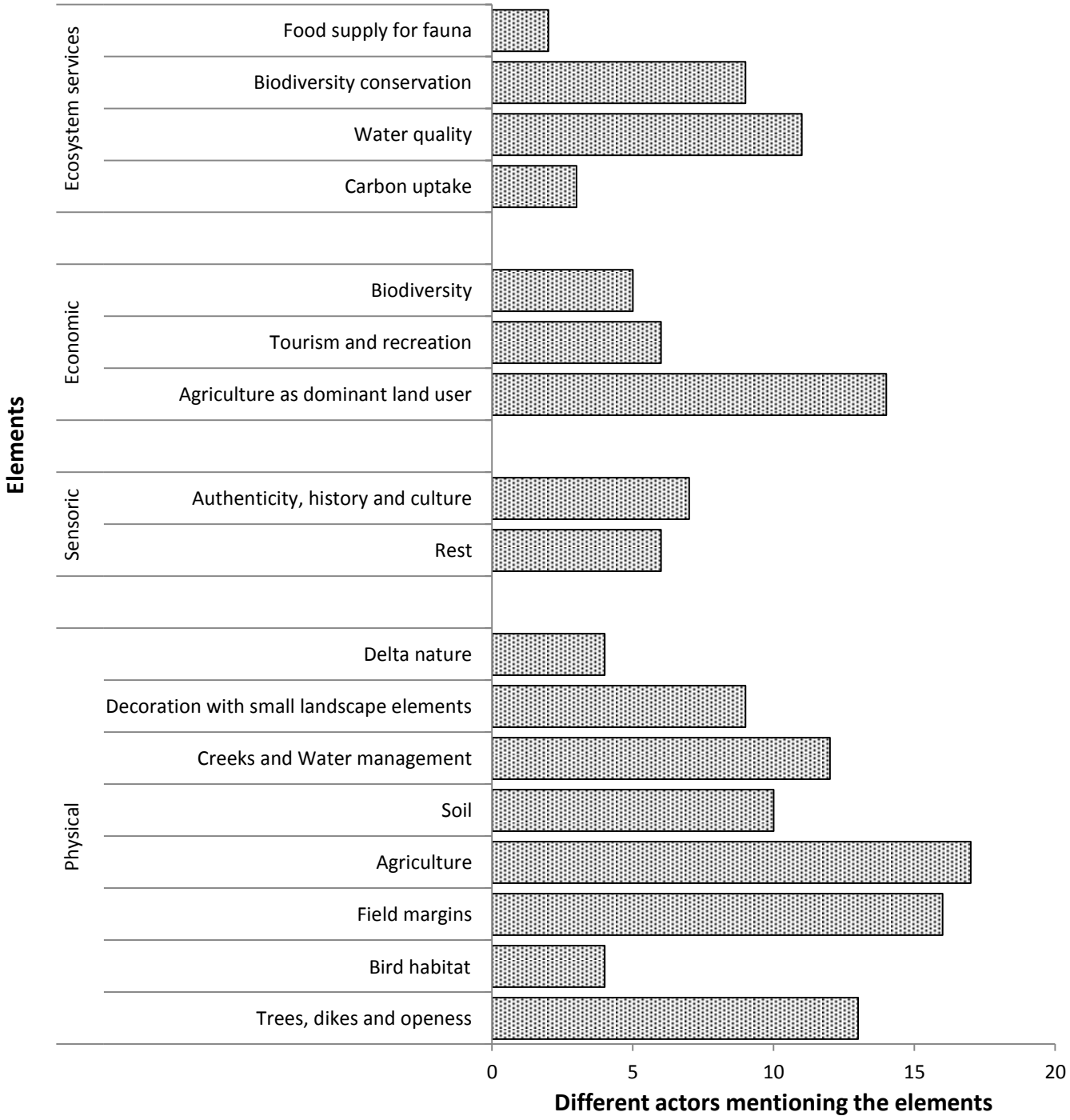


Figure 11. Number of different actors mentioning an element within the category of 'appreciated landscape traits'

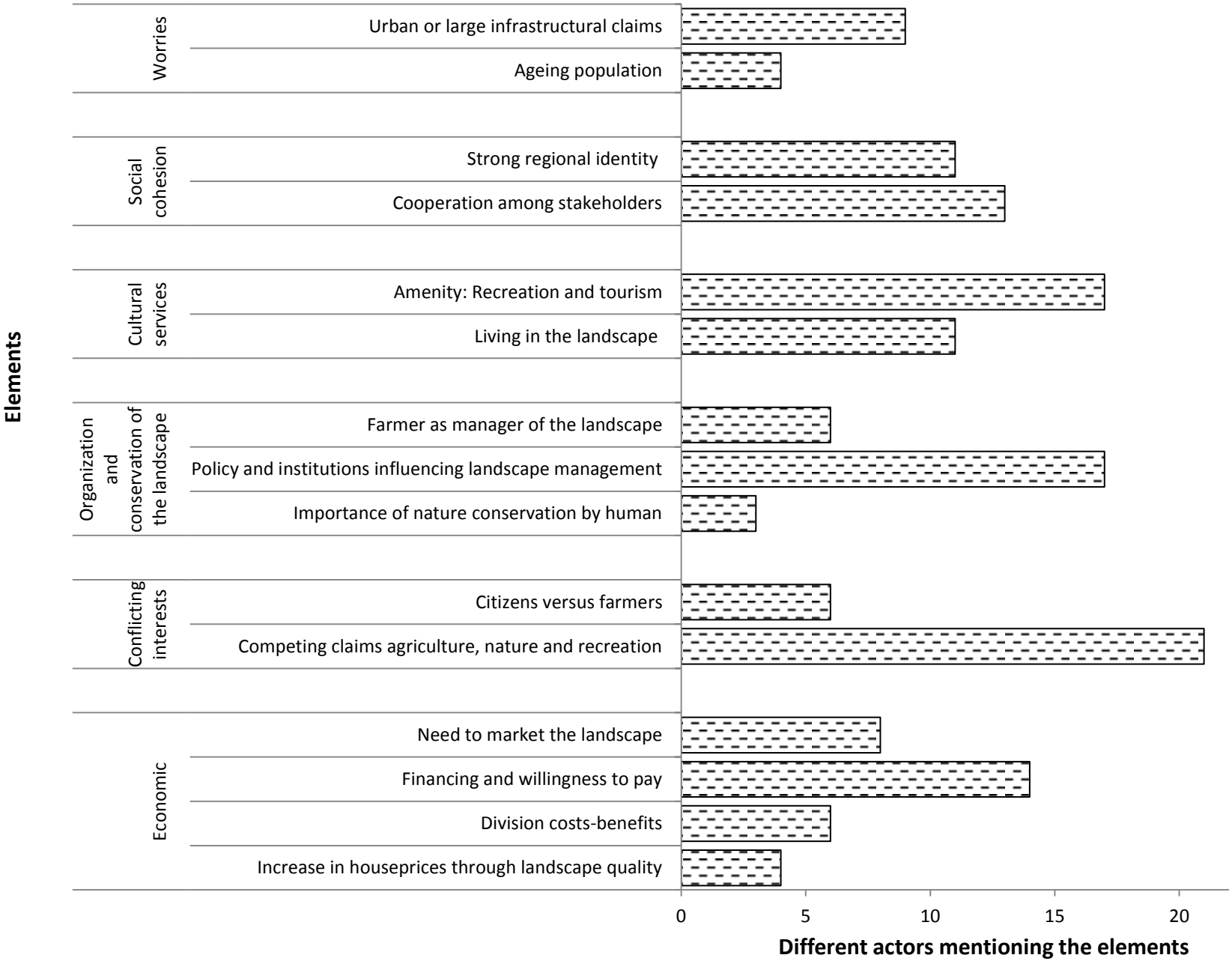


Figure 12. Number of different actors mentioning an element within the category of 'other topics mentioned'

Out of all statements selected from the interviews a final list of 9 objectives in the form of statements is established which is shown in Table 8. Between square brackets it is indicated how many different actors mentioned each (part of the) objective. These objectives show what actors want to optimise in landscape redesign.

Table 8. Final list of actors' objectives; between brackets shows the number of different actors who mentioned the objective

1. Optimise on the agricultural character [15]and high yielding profitable farming systems [11] on the fertile clays soil [10].
2. Optimise on water quality: field margins are appreciated means [9].
3. Optimise on positive effects of biodiversity in field margins on natural pest suppression [12].
4. Optimise on water buffering capacity by creeks [6].
5. Minimalize problems of weeds from field margins; The margin won't pay itself [8].
6. Optimise on bird habitats [8].
7. Optimise on the openness, quietness, dikes and creek structure characterize the Hoeksche Waard [14] for an attractive landscape for recreation [12].
8. Minimise negative influences from nature conservation on agriculture (nature conservation in the Hoeksche Waard should not lead to converting high value, fertile soil into nature area) [10]; optimise the green-blue veining [8].
9. Optimise on small landscape elements like trees around villages or farms [8].

3.3 Component 3: Linking actors' objectives and indicators using MCDM

The scores of the strength of association between the set of 7 indicators (Table 10) and 9 objectives (Table 8) multiplied with the weight regarding the contribution of the set of indicators to non-market and market were given by the 7 experts. This gave a total summed value of the contribution per indicator (X_{Mi} and $X_{NMi;}$ Table 10) to market and non-market benefits. In addition, it indicated to what extent each objective expresses non-market and market net contributions (Y_{Ms} and Y_{NMs}; Table 9)

As the selection of indicators is based on the relevance for ecosystem services in the Hoeksche Waard, the value of Y_s can be used to evaluate the set of ecological indicators. An objective with a high score Y_s expresses the representativeness of the selected indicators in the Hoeksche Waard, according to the experts. For instance, the highest score Y_{NMs} is given to objective 6: *The Hoeksche Waard is a bird habitat*. This indicates that the set of indicators is giving most information about non-market contribution of this objective, in regard to the other objectives. S1, *The Hoeksche Waard has a fertile clay soil, which could allow for high yields by healthy and profitable farms. This fits within a landscape which has a strong agricultural character*, got the highest level of Y_{Ms}, meaning this objective gets most information from the set of indicators related to market benefits. In contrast S9, *The landscape should be more decorated with little landscape elements like trees around villages or farms*, got a very low value for Y_{Ms}. This means that this objective is less represented by the set of

indicators for market benefits, with regard to the other objectives. Preferably the values for Y_s are close together for each objective S_s (partial score NM and M) as large differences would indicate that the set of indicators is better suitable for some objectives and less for others. Figure 13 shows the sum of the Likert scores given by the 7 experts (excluding the contribution to market and non-market benefits) divided by the maximum score which could possibly have been given (245: 7 experts * 7 indicators * a max. score of 5). The higher the number, the better the objective is represented by the set of ecological indicators. As the figure shows, some objectives are better represented (S8: nature conservation vs agriculture, focus on green-blue veining) than other objectives (S4: water buffering capacity). The ratio between non-market and (non-market + market) contributions are displayed in Figure 14, giving an overview of the fraction of non-market benefits of the objectives. The diagram explains which value of market and non-market contribution each objective expresses (based on information given by the indicators). As all values are around 0.5, it means that most objectives express non-market and market contributions (as based on the indicators) to the same extent, according to the experts. Only S1 (agriculture) has a slightly higher value for market contribution and S9 (small landscape elements) has a slightly higher value regarding non-market contribution.

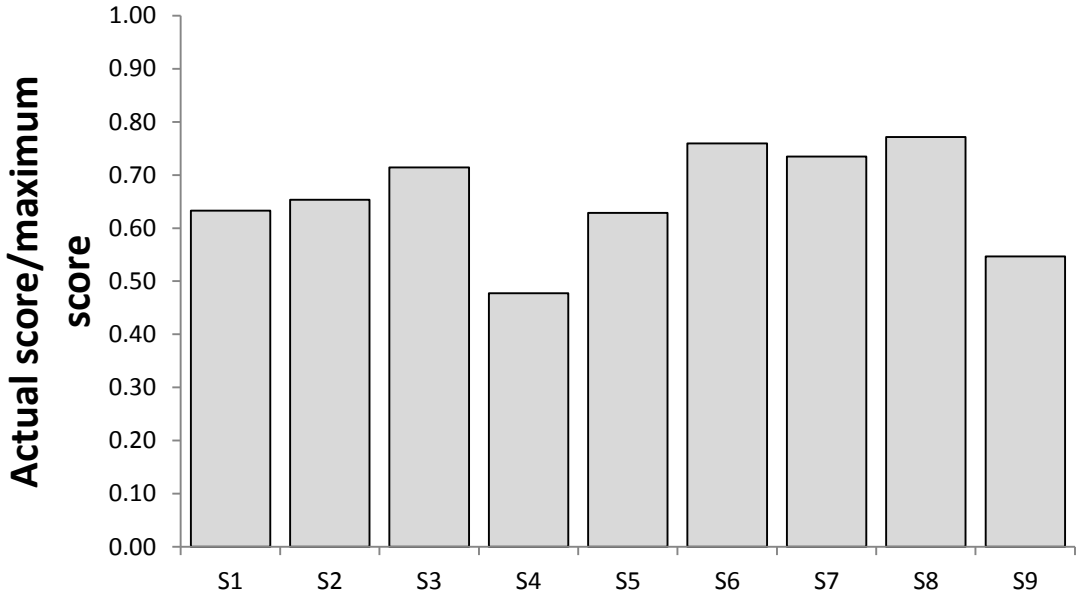


Figure 13. Sum of like scores given by 7 experts per objectives divided by the maximum score (245)

Table 9. Sum of Likert scores given by 7 experts on market and non-market benefits per objective

Objective	S1	S2	S3	S4	S5	S6	S7	S8	S9	Total
Y Non Market	1953	2299	2637	1841	2106	2794	2703	2766	2104	21203
Partial NM score	0.092	0.108	0.124	0.087	0.099	0.132	0.127	0.130	0.099	1.000
Y Market	2799	2460	2380	1608	2456	2581	2513	2742	1680	21219
Partial M score	0.132	0.116	0.112	0.076	0.116	0.122	0.118	0.129	0.079	1.000

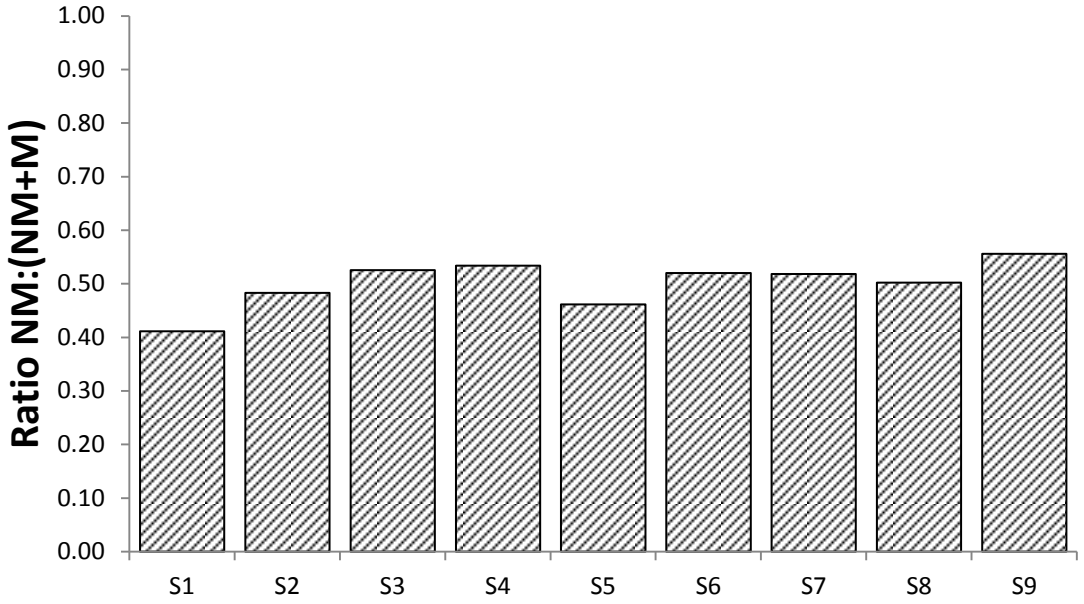


Figure 14. Ratio between non-market and (market + non-market) contributions for each objective

Table 10. Total and partial score of the contribution per indicator for market and non-market benefits obtained by using MCDA

Indicator	X Non Market	Partial NM score	X Market	Partial M score
I1 – visibility dikes	2554	0.120	817	0.039
I2 – agriculture	1970	0.093	5400	0.254
I3 – spatial coherence	5273	0.249	1320	0.062
I4 – diversity margins	2945	0.139	1780	0.084
I5 – creeks and banks	4966	0.234	2065	0.097
I6 – food production	1535	0.072	7322	0.345
I7 – organic agriculture	1960	0.092	2515	0.119
Total	21203	1.000	21219	1.000

Given that the 9 objectives (Table 8) indicate the perceptions and desires of the various actors in the Hoeksche Waard, the highest values of X_s (**Error! Reference source not found.**) refer to the indicators which are most representative and relevant to focus on to gain high non-market or market contribution. 'Spatial coherence of natural landscape elements and length of natural banks' and 'visibility of creeks' give a high contribution to non-market benefits. The indicators related to agriculture (I2, I6 and I7) make a small contribution to non-market benefits of actors in the Hoeksche Waard.

The most contributing ecological indicators for market benefits in the Hoeksche Waard are 'production of food crops' and 'agriculture' in general. The difference between the high values X_M of these two indicators and the lowest values X_M is quite large. Especially the 'visibility of the dike pattern' and the 'spatial coherence of natural landscape elements' show a low contribution to market benefits in the landscape. Remarkable are the indicators like agriculture and spatial coherence which got a high value of X market and X non-market contribution respectively and a low value for the other X. The partial scores for X_{Mi} and X_{NMi} can be used to generate landscape alternatives.

All values (for the strength of association between indicator and objective) given by each expert are displayed in bar diagrams in Appendix II. The diagrams give an indication whether values given by different experts are close together. Notable are the 100 points that are divided over non market benefits and market benefits (Figure 15 and Figure 16). The scores are quite close together for all experts, except for the outlier of I6 of expert 1 regarding the contribution to market benefits. Although experts were not obliged to divide a total of 100 points over all indicators, each expert did do this for both non-market and market contribution. Multiplied with the Likert scores given, the total score of the contribution to non-market benefits is 21203 and for market benefits 21219. The scores are very close, indicating that in total this set of indicators expresses non-market and market benefits equally, taking into account public objectives for the Hoeksche Waard.

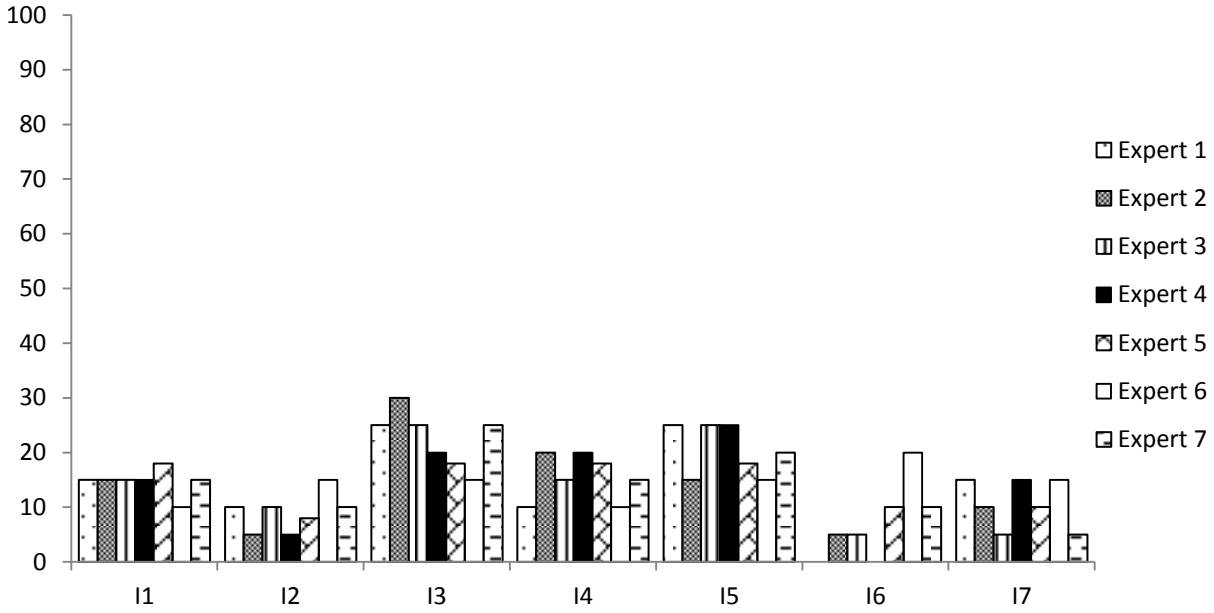


Figure 15. Division of weights given by the 7 experts regarding non-market benefits for each indicator

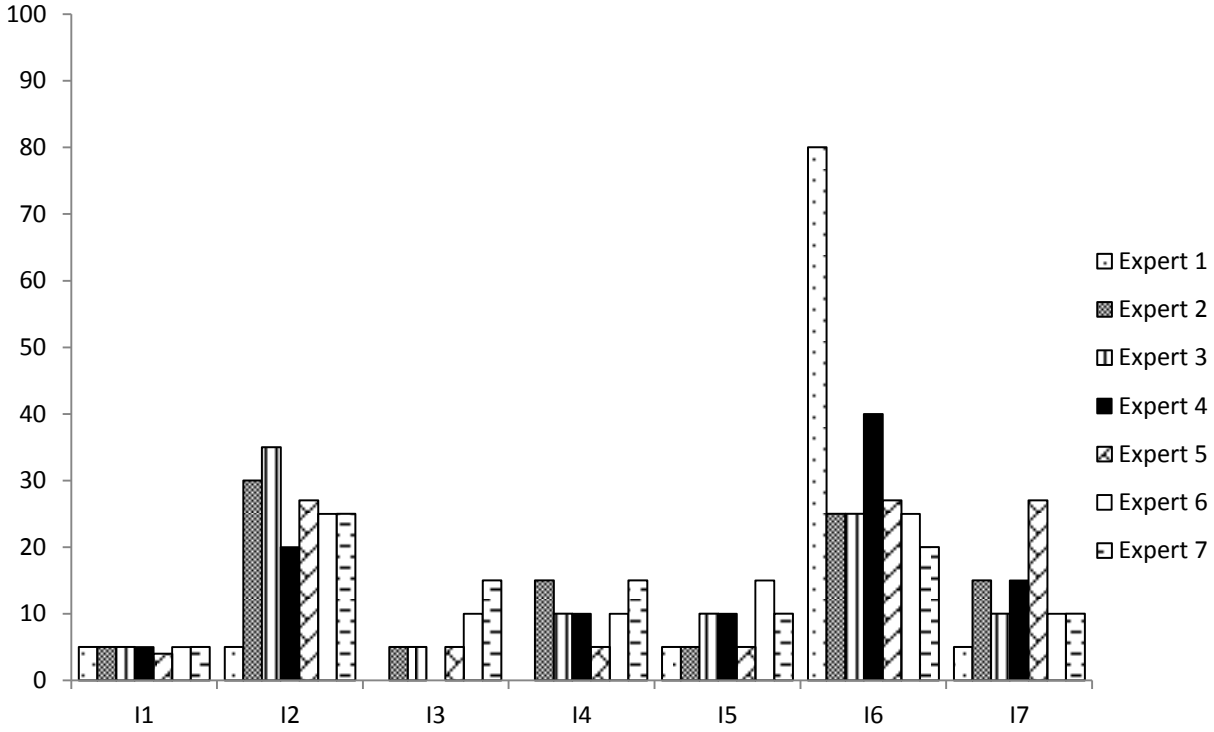


Figure 16. Division of weights given by the 7 experts regarding market benefits for each indicator

4. Discussion

The first section of this chapter will link the results of this study to the research questions. The second section will relate my results to findings from a literature review. Next, limitations and strengths of the study approach will be discussed and finally recommendations for further research will be proposed.

Research results

This thesis study illustrated the large number and variety of actors involved in the landscape Hoeksche Waard (Figure 6). As the actors have different focus points, interests and influences within the landscape (Table 4), competing claims regarding ecosystem services exist regarding three main domains within the Hoeksche Waard: agriculture, nature conservation and recreation. Figure 7, Figure 8 and Figure 9 demonstrate actor matrices for each of these three domains within the Hoeksche Waard. In order to integrate the three domains in the landscape, the matrices support collaboration by indicating, first of all, which actors are the key players in each domain in terms of a high level of influence and a high level of interest. Secondly, the matrices show which actors need to be kept satisfied as their level of influence is high, but not their level of interest. Third, the matrices indicate which actors need to be kept updated, as their level of influence is low, but their level of interest is rather high. The fourth group is least involved and need to be updated when necessary. The matrices show that the division of the actors within the four quadrants differ widely among each dimension, so collaboration with all actors seems essential.

The actor identification was used to select actors to partake in the interviews to make an inventory of the main actors' objectives for ecosystem services within the Hoeksche Waard (Appendix I). The interviews generated a large set of 580 statements. A part of these statements were directly related to demanded ecosystem services and thereby gave insight in desired compositions and configuration of the landscape. These statements were categorised into the following two categories and subdivided over elements within these categories: 1) appreciated landscape traits (Figure 11) and 2) concerns on landscape traits (Figure 7; Figure 10). The main aspects mentioned by the actors in these categories were summarised into the 9 main objectives expressed in the form of statements (Table 8). In the interviews competing claims on ecosystem services between different actor groups were mentioned often as well as urban infrastructural claims, the local cooperation, and many other various aspects were mentioned (Figure 12). These elements are not actual actors' desires for ecosystem services. They rather show clear objectives on landscape management and conservation and can be used to evaluate alternative landscape design. Developed landscape alternatives should not only meet actors' objectives. They should also fit within the context of the Hoeksche Waard (e.g. proper cooperation is required).

To translate the main objectives for ecosystem services in the Hoeksche Waard into the set of measurable ecological indicators, the MCDM approach was used. First, the results per objective are presented. Figure 13 shows the results of the total scores for the strength of association between the 9 objectives and the set of 7 measurable ecological indicators (Table 2) given by the 7 experts for each objective divided by the maximum score of 245. The scores indicate the representativeness of the objectives by the indicators, according to the experts. The closer the total score to the maximum score of 245, the better the objective is represented by the indicators. However, some objectives got lower scores than other objectives, indicating that the total set of indicators represent some objectives better than others. This would mean that some objectives will be more represented in designed landscape alternatives than others. Figure 14 shows the ratio of non-market and the total

of contributions, expressed by each objective in association with the indicators. The fraction of non-market benefits expressed by each objective is for the majority of objectives around 0.5 (+0.05 or -0.05), indicating the majority of objectives express the contribution to market and non-market benefits quite equally. The fraction of S1 is somewhat smaller (0.41) and the fraction of S9 is a bit larger (0.56).

The contribution to non-market and market benefits of the set of measurable ecological indicators are presented in Table 10. The outcomes of the partial scores can be used as input to develop landscape alternatives for the Hoeksche Waard based on actor' objectives for ecosystem services. The scores for the contribution of each indicator to market and non-market benefits are quite close. This indicates that, according to the experts, in total this set of indicators expresses non-market and market benefits equally, taking into account the set of public objectives for the Hoeksche Waard. The division of the scores for market and non-market contribution over the indicators ranges quite a lot. This means that some indicators (food production) give a very high contribution to market benefits. Other indicators (visibility of dikes) have a very limited contribution to market benefits of the landscape. Spatial coherence gives the highest contribution to non-market benefits, while the production of food is giving the lowest contribution to non-market benefits. However, the difference between the highest and lowest score for non-market contribution is smaller than the difference for market contribution. For instance, experts consider the production of food crops to be of influence on non-market benefits. Although this contribution is rather small, it is not as small as the lowest contributing indicator to market benefits. This could indicate that actors in the Hoeksche Waard not only appreciate the production of food crop from an economic point of view, but they might also like to see crops grown (increase in well-being).

Relation to other findings

The interviews with the involved actors in the Hoeksche Waard showed that the current agricultural character with its dikes and creeks (green blue veining) is highly appreciated. It was mentioned several times by various actors that agriculture should remain the dominant land use within the Hoeksche Waard (Figure 11). People appreciate conservation of for instance the creek structure and field margins and a variety of actors disapprove forcing nature conservation by converting high fertile soil into nature area (Table 8). Several actors seem to be apprehensive towards large changes in the landscape as they want to keep their strong local identity. Part of this identity are the 'island mentality', the green bleu veining and the agricultural character of the area. Plieninger *et al.* (2013) explored the future of ecosystem services within a landscape in Germany. Using actor discussion they developed four landscape scenario narratives. Key features of each scenario were described based on a list of landscape aspects (e.g. agriculture, tourism, employment). To translate this approach to the Hoeksche Waard, based on the interview results, two scenarios could be developed. As previously mentioned, from the interviews it became clear that local citizens highly appreciate the agricultural character of the Hoeksche Waard. Hence the main land use characteristic of both scenarios will be agriculture. The two scenarios that will be described are 1)'local sale' and 2) 'international trade'. What we will compare in this example is an agricultural landscape, in which one scenario emphasizes small-scale agriculture with a focus on the local character of the area, versus a scenario that focusses on being a leader in European agriculture and agricultural trade (concepts based on statements mentioned within elements of Figure 11). Table 11 gives an overview of the main scenario aspects relevant for the Hoeksche Waard. The aspects are based on the scenario design of Plieninger *et al.* (2013) and items mentioned in the interviews. This scenario design illustrates two extreme, agricultural dominated, landscape alternatives, to represent the wide range of possible landscape alternatives within an agriculture based landscape.

Table 11. Aspect describing two different agricultural landscape scenarios for the Hoeksche Waard
Based on: (Plieninger *et al.* 2013)

Aspects	Local sale	International trade
Description	Product quality, origin and authentic rural landscape are central.	Efficiency, quantity and highly profitable agriculture are important aspects.
Landscape (identity)	Small plots and extensive grasslands with meandering creeks integrated within the aesthetically appearing landscape - spatial coherence.	Large plots and grasslands (intensive) within an open agricultural based landscape which makes dikes and creeks highly visible.
Policy and institution	High level of regional cooperation of local actors within one municipality 'Hoeksche Waard'. 'Greening' measure from CAP is implemented by the HW collective in the form of field margins. Regional decision making.	High level of international market integration; competition precludes local cooperation. EFA's are individually implemented, where possible ditches and banks are included. Most influence is exerted by agricultural related actors.
Recreation	Recreation within an agricultural based landscape with tours on and around farm fields. In combination with natural landscape elements an attractive area for recreation.	Recreation and agricultural sector are separated - recreation on the destined paths only. Especially suitable for recreants who prefer open and a monoculture landscape.
Agriculture	Besides many general crops, local products are grown (like 'Hoeksche Rooie' potato). There are various farm shops around the area. Field margins or other natural elements are grown around most fields and organic or sustainable integrated agriculture is widespread.	This includes large scale (up scaling) intensive agriculture in which at least 3 cash crops are grown (obligatory in CAP). Natural areas (and field margins) near farm fields are reduced as much as legally permitted.
Nature	There is large spatial coherence along the island between various natural areas. The delta areas are preserved for nature as well as areas around creeks. The level of biodiversity is high with many natural elements. Agriculture and nature conservation are integrated by for instance field margins and dense network.	Main focus is on management and conservation of creeks and their borders, ditches and dikes. Nature and agriculture are spatially segregated and the integration is very limited - only where required by subsidies. Highly fertile agricultural soil remain destined for agriculture.
Public vs Private benefits	A balance between public and private benefits is found in which the farmers earn a fair income, but the wellbeing of inhabitants is high as well.	Main focus on private benefits in which public benefits are mainly achieved by the natural elements present on certain spots around the landscape.

Participatory landscape design performed by Tress and Tress (2003), Palang *et al.* (2000) and Shearer (2005) allow local participation after different landscape scenarios were set up by the researchers, in which Palang *et al.* (2000) gives the option of no change as well. These scenario visualisations could initiate interesting discussion about future landscape conservation and development. Feedback on designed scenarios from discussion panels seem advantageous in landscape redesign. In the Hoeksche Waard another approach is used where first the main objectives for ecosystem services of the actors are researched. These objectives will be used as public input to design alternative landscape in a continuing research. Because of the input of actors' objectives in the design of landscape alternatives, these alternatives might realistic to implement and close to desires of local actors. The designed landscape alternatives could give a applicable and validated opening for actor discussion. As explained before, actors in the Hoeksche Waard seem quite satisfied with current characteristics of the landscape (e.g. agriculture, trees and dikes) (Figure 11 and chapter 3.2). The research by Tress and Tress (2003) comes up with more or less the same conclusion: their local participants seemed to be quite satisfied with the current landscape. The research of Soliva and Hunziker (2009) demonstrates most actors would prefer the visual qualities of a landscape scenario which reminds them of the past (before mechanisation of agriculture). However, in the overall assessment, which also included biodiversity and socio-economic aspects, "*Business as Usual*" scenario was most preferred. The *Business as Usual* scenario is explained as "a trend extrapolation that extends the present trends of landscape development into the future". This result seems to correspond with the results from the Hoeksche Waard: actors might be open for landscape redesign, though with regard to current characteristics. Palang *et al.* (2000) conclude "Socio-economic changes tend to induce landscape changes as well [...] landscape tends to be more than just the sum of elements comprising it; landscape has its identity, its distinguishable character. While planning actions, this identity of a landscape should be kept in mind". The involved public in the case study of Palang *et al.* (2000) prefer a land use change towards a scenario which ensures higher economic welfare. According to Tress and Tress (2003) one should try to make each scenario equally attractive from an economic point of view: "Obviously, changes in landscape development are not welcome unless economic or social benefits can be derived from them". Especially without background knowledge of actors' preferences, it might be difficult to develop scenarios which are all more or less equal attractive regarding socio-economic aspects. In this thesis study the distinction between the contribution to non-market and market benefits of the set of measurable indicators has been made. Landscape alternatives generated based on the set of 7 indicators will show trade-offs between market and non- market benefits to consider Pareto optimal alternatives (one objective cannot be reached without compromising another objective, e.g. high non-market benefit vs high market benefits). According to Soliva and Hunziker (2009) "it is preferable to explicitly discuss livelihood aspects with the actors, rather than make weakly founded assumptions beforehand".

The interviews and conversations with the local actors indicated that there are underlying competing claims in the Hoeksche Waard. Several other issues playing a part in the Hoeksche Waard apart from ecological aspects were mentioned. Various social-cultural, political and institutional topics regarding ecosystem services are mentioned and discussed by almost all actors (Figure 12). Schut *et al.* (2013) explain 5 dimensions influencing negotiations of the competing claims which often include: biophysical, social-cultural, economic, institutional and political dimensions. According to Schut *et al.* (2013) solutions and management of competing claims on natural resources require an understanding of the 5 dimensions within the area. The biophysical dimension is already discussed and statements related to this dimension can be found in the elements of Figure 10 and Figure 11.

Statements related to the economic dimension can also be found within these Figures. Statements within the elements of Figure 12 provide information on the other dimensions. This 5 dimensional framework shows that landscape redesign should be examined in a wide context. This in order to increase the likelihood of being accepted, adopted and implemented by the actors (public, organisation, governments). An ecological landscape design should fit within all local conditions of a landscape. E.g. if collaboration between organisations within the nature domain and the agricultural domain is needed while this is limited in the current situation, the scenario implementation would fail, unless a change were to be carried out. In addition, the importance of taking into account a large variety of actors is recognized in chapter 3.2, as they are participating and collaborating in various dimensions. Actor analyses done within the three domains of agriculture, nature conservation and recreation can support cooperation (Figure 7, Figure 8 and Figure 9).

Strengths and limitations of research approach

The approach used in this research showed several benefits. As actors from almost all actor groups participated (Appendix I), the interviews provided a rich insight in the variety of demands and objectives for ecosystem services within the Hoeksche Waard (Table 8; Figure 10; Figure 11; Figure 12). To ensure a consistent analysis of interview results, labelling and categorising of statements only started after the last interview had been transcribed. Next, subsequent steps were taken to reduce to the 9 objectives. Speaking for hours with the actors gave the interviewer a good insight and knowledge about issues going on in the area: what is important, what occupies people, what do they like, what are they worried about? This makes the interviewer more able to make substantial choices. Using an MCDM approach a translation of actors' objectives to measurable indicators was possible. The results can provide for the design of landscape alternatives, based on the major demands of actors involved in the area, including market and non-market benefits (Table 10). One of the discussions going on in the Hoeksche Waard is about who is paying the costs and who is benefiting from the landscape. Therefore landscape redesign based on market and non-market benefits offers room for actor discussion on trade-offs between market and non-market benefits of possible landscape objectives and alternatives. Seven experts were asked to participate in this MCDM approach. Each expert is assumed to have a high level of expertise. The indicated strengths of association of the statements and indicators are quite close for all experts (Figure 15, Figure 16 and Appendix II).

With this approach, challenges and limitations were also encountered. First of all, this research used a local approach in which no actors from higher governments, like the province, are taken into account. However, the Hoeksche Waard is not a closed system, as it is influenced externally (e.g. policies decision taken at a higher level). The current process of decentralisation, regional developments and changes in CAP evoke actors to improve collaboration. The actor analysis and inventory of actors' demands for ecosystem services would have been more complete by taking into account external actors whom are involved in the Hoeksche Waard as well, e.g. policy officers from the ministry of economic affairs. Secondly, actors' ecological demands and desires were needed to get a complete insight in land use objectives: how should the landscape be used? What should the landscape look like? Questions regarding ecological aspects within the landscape were asked, though it was noticeable that several actors had limited knowledge or interest in ecological landscape functions and guidance from the interviewer on this topic was necessary. In the majority of interviews the topic switched quite rapidly from ecology to social aspects related to the landscape and ecosystem services, of which most actors were much more involved. It became obvious that social aspects (like cooperation, landscape management, competing claims on ecosystem services,

government, local identity) are highly important topics at landscape level in the Hoeksche Waard. After the 9 objectives were established, they were sent to all participants for their information. However a more validating or confronting feedback phase in which actors were asked whether the objectives were within their expectations did not take place could have been informative.

Third, in the MCDM approach only experts were asked to indicate the strength of association between each indicator and each objective and weight the relative importance of each indicator towards market and non-market benefits. In order to take personal preferences into account various actors could have been asked to indicate their importance of each indicator. Personal preference takes into account the fact that one indicator will be more important to an actor compared to another indicator in the Hoeksche Waard.

Further research and recommendations

This thesis research provides results for two steps (step 1 and step 3) that are part of a larger research framework to develop alternative landscapes for the Hoeksche Waard (Figure 1). The ecological indicators form the basis inputs for the modelling software 'Landscape IMAGES' which generates and optimizes a solution space consisting of a cloud of alternative landscapes. The scores of the indicators from the MCDM approach are used in order to include actors' objectives into Landscape IMAGES as well (Table 10). In this way, alternative landscapes can be generated based on the actors' main objectives and the set of measurable ecological indicators for the Hoeksche Waard. Since each indicator got a value regarding the contribution to market and non-market benefits, it will influence trade-offs that can be explored between the non-market and market benefits for each alternative generated. Moreover, the division in non-market and market benefits enables to recommend on policy measures to encourage land use change, when alternative landscape are established, based on Pannell (2008) (chapter 1.1). Modelling with Landscape IMAGES will be carried out in another thesis project.

A few recommendations will be given on further research approaches. Participating actors were asked to answer the interview questions from their personal point of view as the majority of the interviewees is involved in several actor groups. This resulted in a very broad range of responses and discussion topics. However, an actor analysis identifying specific objectives of the various actor groups was not possible. The possibility of an actor analysis should be reconsidered to compare opinions, demands and desires for ecosystem services of the various actor groups. This would generate opportunities to discuss targeting strategies for cooperation, actor analyses and policy measures. Sheppard and Meitner (2005) used separate actor groups in their research towards criteria for sustainable forest management (SFM). In this MCA (Multi Criteria Analysis), individuals from actor groups (different group sizes, ranging from 4 to 8 members), were asked to divide 30 points over 9 criteria for SFM. The average of each group is shown in a diagram giving a good overview of the criteria of each group about SFM. An analysis was done to discover significant variances among actor groups. They found their method to be very successful and effective, especially in their region in British Colombia which is a conflict-prone area. The results of all groups were found to be considerably close, meaning most actor groups rate the same criteria as most relevant for SFM, which surprised the participants. Even actor groups who were expected to have conflicting thoughts, like the forestry and environmental group, showed only significant differences in 2 out of 9 criteria. When they were asked to weight the top-prior criteria, there were more significant differences shown. In our research MCDM is used as well, though with the use of experts instead of actors. We turned to experts to indicate the relevance of each statement to each

ecological indicator, since this task is quite difficult and expertise and ecological knowledge is needed. However, as discussed previously, it would be nice to get a more complete overview of the specific demands of actor groups. As the Hoeksche Waard has some contradicting actor groups, like nature and agricultural related organisations, this research approach in combination with MCDM could give insights for strategy development towards proper cooperation. A complete overview of actor's desires and opinions could benefit actor understanding. Indeed as in the research of Sheppard and Meitner (2005) we could get the insight that different actor groups are more closely related than believed.

To implement a certain landscape scenario or alternative the land use change has to be adopted by the local actors. A feedback phase with local actors is needed in further research. Discussing suggested landscape scenarios with local actors could be done as it was carried out by Tress and Tress (2002); Buchecker *et al.* (2003); Shearer (2005). However, these studies did not use primarily actor input to design these landscape scenarios. Showing the landscape alternatives or scenarios to the actors and let them assess the designs on 'feasibility' and 'interest' on a scale from 1 to 10 would be ideal. This is especially interesting when the actors' objectives are used in modelling tools like LandscapeIMAGES. When analysing thoughts towards 'feasibility' and 'interest' among the actors, one could say something about the expected adoption rate and the reality of the designs, taking into account the large variety of actors with their particular attitudes and desires. What alternative will have the best chance to succeed? In addition, every actor group has different levels of power and interests which vary among different landscape scenarios. Each actor has its own level of trust, relations, incentives and goals, but do they understand one another? (Schut *et al.* 2010). The actor analysis done in this study (Figure 7, Figure 8 and Figure 9) illustrates underlying relationships within the Hoeksche Waard. To validate the actor analysis, a survey could be conducted among the actors involved. In this survey they would asked to indicate their power and interest of the other actors for a certain bottom-up landscape scenario, on a scale of 1-10. Actors involved in the Hoeksche Waard seem very aware of the importance of collaboration at the landscape level, but, as they realise, there is ample room for improvement.

5. Conclusion

This study aimed to make an inventory of the major demands and desires for ecosystem services for the main actors involved in the Hoeksche Waard. Interviews conducted among the participating actors to identify actors' objectives for ecosystem services showed a large variety of aspects mentioned. The aspects ranged from appreciated landscape traits and concerns on landscape traits to other aspect mentioned (e.g. competing claims on ecosystem services and the social cohesion within the landscape). There is a large variety of actors involved in the Hoeksche Waard and the interview data showed there are competing claims regarding the domain of agriculture, nature conservation and recreation. All actors have different interests and power/influences within each of these three domains. The actor analysis suggested on cooperation of actors within the three domains by assessing the interests of the actors versus their power/influence. The actor matrices showed which actors are the key players, the less important actors and the actors which need to be kept updated and satisfied within each domain.

The main actors' objectives towards landscape redesign were translated into a set of measurable landscape indicators for the Hoeksche Waard, by using a MCDM method. The set of indicators, determined in another thesis research, can be implemented in modelling tools like

'LandscapeIMAGES' and form the basis for generating landscape alternatives. The translation of the 9 main actors' objectives into the set of measurable ecological indicators is an important step for modelling landscape alternatives based on actors' demands. However, the data showed that not all objectives are equally represented by the indicators, according to the experts. The experts also indicated the contribution of each indicator regarding non-market and market benefits. By doing this, each modelled landscape alternative, as based on the indicators, will get a value for market and non-market benefits. The value of non-market (NM/(NM+M)) contribution which each objective expresses (based on information given by the indicators) is around 0.5. This means that the objectives, as associated with the indicators, express non-market and market contributions to the same extent, according to the experts. There are two exceptions: S1 which is related to agriculture has a slightly higher value for market contribution and S9, related to the demand of small landscape elements, has a slightly higher value regarding non-market contribution.

It is recommended for further steps of this research approach, in which landscape alternatives will be generated, to evaluate the developed alternatives with data from the interviews. The interview data did not only give an insight into desires and demands for ecosystem services, but also gave objectives related to management and cooperation within the landscape. Future research should take into account a more confronting approach of validation from the participating actors in all stages of the research (e.g. to validate the actor analysis, the established objectives and at the end to validate the feasibility of the developed landscape alternatives). Embedding actors in validation can enable realistic outcomes of alternative landscapes while limiting conflicts.

6. References

Antrop, M. (2005). "Why landscapes of the past are important for the future." Landscape and Urban Planning **70**(1): 21-34.

Bennett, E. M., G. D. Peterson and L. J. Gordon (2009). "Understanding relationships among multiple ecosystem services." Ecology Letters **12**(12): 1394-1404.

BiodivERsA (2013). BiodivERsA Stakeholder Engagement Toolkit. Consultation Draft. . Paris, BiodvERsA.

Boyd, J. and S. Banzhaf (2007). "What are ecosystem services? The need for standardized environmental accounting units." Ecological economics **63**(2–3): 616-626.

Buchecker, M., M. Hunziker and F. Kienast (2003). "Participatory landscape development: overcoming social barriers to public involvement." Landscape and Urban Planning **64**(1–2): 29-46.

Chan, K. M., M. R. Shaw, D. R. Cameron, E. C. Underwood and G. C. Daily (2006). "Conservation planning for ecosystem services." PLoS biology **4**(11): e379.

Costanza, R., R. d'Arge, R. De Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'neill and J. Paruelo (1997). "The value of the world's ecosystem services and natural capital." nature **387**(6630): 253-260.

Dewulf, A., M. Craps, R. Bouwen, T. Taillieu and C. Pahl-Wostl (2005). "Integrated management of natural resources: dealing with ambiguous issues, multiple actors and diverging frames." Water science and technology **52**(6): 115-124.

Díaz, S., D. Tilman, J. Fargione, F. Chapin III, R. Dirzo, T. Kitzberger, B. Gemmill, M. Zobel, M. Vila and C. Mitchell (2005). "Biodiversity regulation of ecosystem services." Ecosystems and human well-being: current state and trends **1**: 297-329.

Doorn van, A. M., T. C. P. Melman, W. Geertsema, B. S. Elbersen, H. Prins, A. H. F. Stortelder and R. A. Smidt (2012). Vergroening van het GLB door Ecological Focus Area's - Verkenning van doelen, randvoorwaarden, kosten en baten. Alterra-rapport 2296, Alterra.

Dutta, R. and T. Burgess (2003). "Prioritising information systems projects in higher education." Campus-Wide Information Systems **20**(4): 152-158.

Evers, D. (2012). Verschuivende schalen: de implicaties van de decentralisatie van ruimtelijk beleid tegen het achtergrond van toenemende Europeanisering, Planbureau voor de Leefomgeving

Fagerholm, N., N. Käyhkö, F. Ndumbaro and M. Khamis (2012). "Community stakeholders' knowledge in landscape assessments – Mapping indicators for landscape services." Ecological Indicators **18**(0): 421-433.

Fisher, B., R. K. Turner and P. Morling (2009). "Defining and classifying ecosystem services for decision making." Ecological economics **68**(3): 643-653.

Fraser, E. D., A. J. Dougill, W. E. Mabee, M. Reed and P. McAlpine (2006). "Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management." Journal of Environmental Management **78**(2): 114-127.

Fülöp, J. (2005). Introduction to decision making methods. BDEI-3 Workshop, Washington, Citeseer.

Haasnoot, R. (2013). "Decentralization of Dutch Nature Policy: Opportunities and Threats for Nature."

Hall, C., A. McVittie and D. Moran (2004). "What does the public want from agriculture and the countryside? A review of evidence and methods." Journal of Rural Studies **20**(2): 211-225.

Höppner, C., J. Frick and M. Buchecker (2007). "Assessing psycho-social effects of participatory landscape planning." Landscape and Urban Planning **83**(2–3): 196-207.

HWL. (N.D.). "Hoeksche Waards Landschap." 2013, from http://www.hwl.nl/#!homepage.

Instructional Assessment Resources Website. (2007). "Assess technology: approaches to selecting solutions." Retrieved 26-9, 2013, from http://www.utexas.edu/academic/ctl/assessment/iar/programs/plan/types/needs-solutions.php?task=tech.

Janssen, J., N. Pieterse, L. van den Broek and N. Noorman (2007). Nationale landschappen: beleidsdilemma's in de praktijk, NAi Uitgevers.
Kremen, C. (2005). "Managing ecosystem services: what do we need to know about their ecology?" Ecology Letters **8**(5): 468-479.
Kumar, R. (2011). Research Methodology. a step-by-step guide for beginners. London, SAGE Publications Ltd.
Li, X. (2011). "Emergence of bottom-up models as a tool for landscape simulation and planning." Landscape and Urban Planning **100**(4): 393-395.
Linkov, I. and E. Moberg (2011). Multi-criteria decision analysis: environmental applications and case studies, CRC Press.
Linkov, I. and J. Steevens (2008). "Appendix A: Multi-Criteria Decision Analysis." Advances in experimental medicine and biology **619**: 815.
Luck, G. W., K. M. A. Chan and J. P. Fay (2009). "Protecting ecosystem services and biodiversity in the world's watersheds." Conservation Letters **2**(4): 179-188.
MacDonald, D. H., R. Bark, A. MacRae, T. Kalivas, A. Grandgirard and S. Strathearn (2013). "An interview methodology for exploring the values that community leaders assign to multiple-use landscapes." Ecology and Society **18**(1).
Ministerie van Landbouw Natuurbeheer en Visserij (2002). Vaststelling van de begrotingsstaat van het Ministerie van Landbouw, Natuurbeheer en Visserij (XIV) voor het jaar 2003. n. e. v. Landbouw. Den-Haag.
Nieuwenhuizen, W., A. Gerritsen and I. Coninx (2013). "Nieuwe tijden voor het landschapsbeleid?" Landschap: tijdschrift voor Landschapsecologie en Milieukunde **30**(1): 21-26.
O'Farrell, P. J. and P. M. L. Anderson (2010). "Sustainable multifunctional landscapes: a review to implementation." Current Opinion in Environmental Sustainability **2**(1–2): 59-65.
Palang, H., H. Alumäe and Ü. Mander (2000). "Holistic aspects in landscape development: a scenario approach." Landscape and Urban Planning **50**(1–3): 85-94.
Pannell, D. J. (2008). "Public benefits, private benefits, and policy mechanism choice for land-use change for environmental benefits." Land Economics **84**(2): 225-240.
Pannell, D. J. (2008). Public: private benefits framework version 3, INFFER Working Paper 0805.
Plieninger, T., C. Bieling, B. Ohnesorge, H. Schaich, C. Schleyer and F. Wolff (2013). "Exploring futures of ecosystem services in cultural landscapes through participatory scenario development in the Swabian Alb, Germany." Ecol Soc **18**(3): 39.
Rapport, D. J., C. Gaudet, J. R. Karr, J. S. Baron, C. Bohlen, W. Jackson, B. Jones, R. J. Naiman, B. Norton and M. M. Pollock (1998). "Evaluating landscape health: integrating societal goals and biophysical process." Journal of Environmental Management **53**(1): 1-15.
Reed, M. S., A. Graves, N. Dandy, H. Posthumus, K. Hubacek, J. Morris, C. Prell, C. H. Quinn and L. C. Stringer (2009). "Who's in and why? A typology of stakeholder analysis methods for natural resource management." Journal of Environmental Management **90**(5): 1933-1949.
Requirements Techniques. (N.D.). "Stakeholder power/interest analysis." from http://requirementstechniques.wordpress.com/stakeholder-analysis/stakeholder-powerinterest-analysis/.
Reyers, B., P. J. O'Farrell, R. M. Cowling, B. N. Egoh, D. C. Le Maitre and J. H. Vlok (2009). "Ecosystem services, land-cover change, and stakeholders: finding a sustainable foothold for a semiarid biodiversity hotspot."
Sandhu, H. S., N. D. Crossman and F. P. Smith (2012). "Ecosystem services and Australian agricultural enterprises." Ecological economics **74**(0): 19-26.
Schut, M., C. Leeuwis and A. van Paassen (2010). "Room for the River: Room for Research? The case of depoldering De Noordwaard, the Netherlands." Science and Public Policy **37**(8): 611-627.
Schut, M., A. van Paassen, C. Leeuwis and L. Klerkx (2013). "Towards dynamic research configurations: A framework for reflection on the contribution of research to policy and innovation processes." Science and Public Policy: sct048.

Shearer, A. W. (2005). "Approaching scenario-based studies: three perceptions about the future and considerations for landscape planning." Environment and planning B: Planning and Design **32**(1): 67-87.

Sheppard, S. R. J. and M. Meitner (2005). "Using multi-criteria analysis and visualisation for sustainable forest management planning with stakeholder groups." Forest ecology and management **207**(1–2): 171-187.

Soliva, R. and M. Hunziker (2009). "Beyond the visual dimension: Using ideal type narratives to analyse people's assessments of landscape scenarios." Land Use Policy **26**(2): 284-294.

Steele, K., Y. Carmel, J. Cross and C. Wilcox (2009). "Uses and Misuses of Multicriteria Decision Analysis (MCDA) in Environmental Decision Making." Risk Analysis **29**(1).

Tress, B. and G. Tress (2002). "Shaping future landscapes: The scenario approach." Agricultural impacts on landscapes: 67.

Tress, B. and G. Tress (2003). "Scenario visualisation for participatory landscape planning—a study from Denmark." Landscape and Urban Planning **64**(3): 161-178.

van Alebeek, F. and O. A. Clevering (2005). Gebiedsplan FAB Hoeksche Waard; Naar een aantrekkelijk platteland met een natuurlijke omgeving als probleemoplosser voor het agrarisch bedrijf, Praktijkonderzoek Plant & Omgeving B.V.; Sector Akkerbouw, Groene Ruimte en Vollegrondgroenteteelt.

van Alebeek, F., A. Visser and R. van den Broek (2007). "Akkerranden als (winter) schuilplaats voor natuurlijke vijanden." ENTOMOLOGISCHE BERICHTEN-NEDERLANDSCHE ENTOMOLOGISCHE VEREENIGUNG **67**(6): 223.

van Arkel, F. (2012). Tussen angst en ambitie: een onderzoek naar de kansen en bedreigingen van de decentralisatie van het natuurbeleid Master thesis, Universiteit Utrecht.

van Puijenbroek, P., R. van Oostenbrugge, N. Pieterse and H. Stolwijk (2006). Hoofdstuk 8: Natuur. Welvaart en Leefomgeving, Centraal Planbureau, Milieu- en Natuurplanbureau en Ruimtelijk Planbureau**:** 377-418.

ZKA Consultants and planners (2012). Economische betekenis toerisme en recreatie Hoeksche Waard, Huidige situatie (2011) en ontwikkeling (2007-2011), VVV Zuid-Holland zuid.

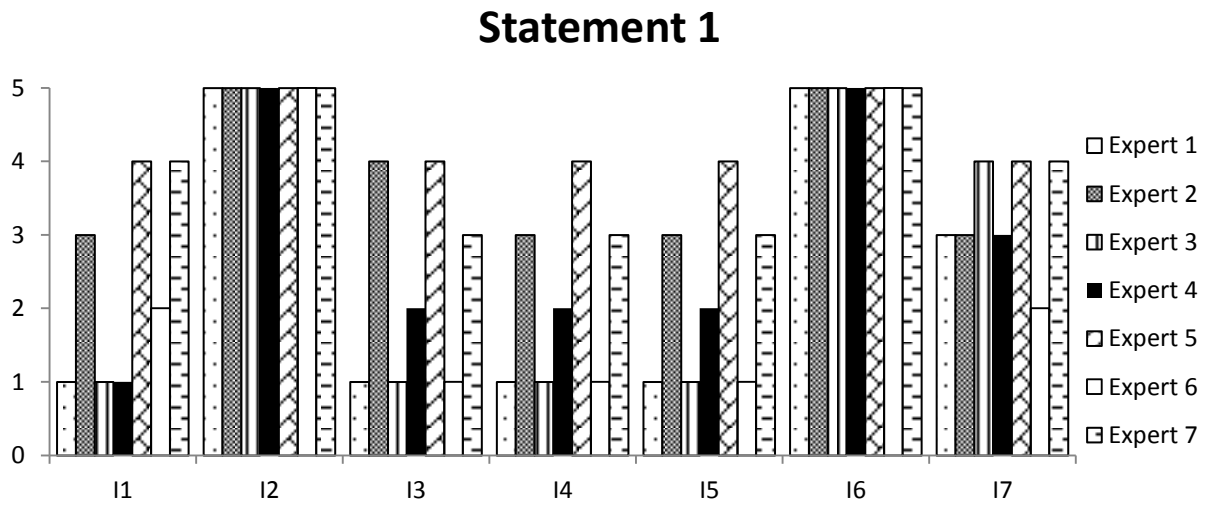
Appendices

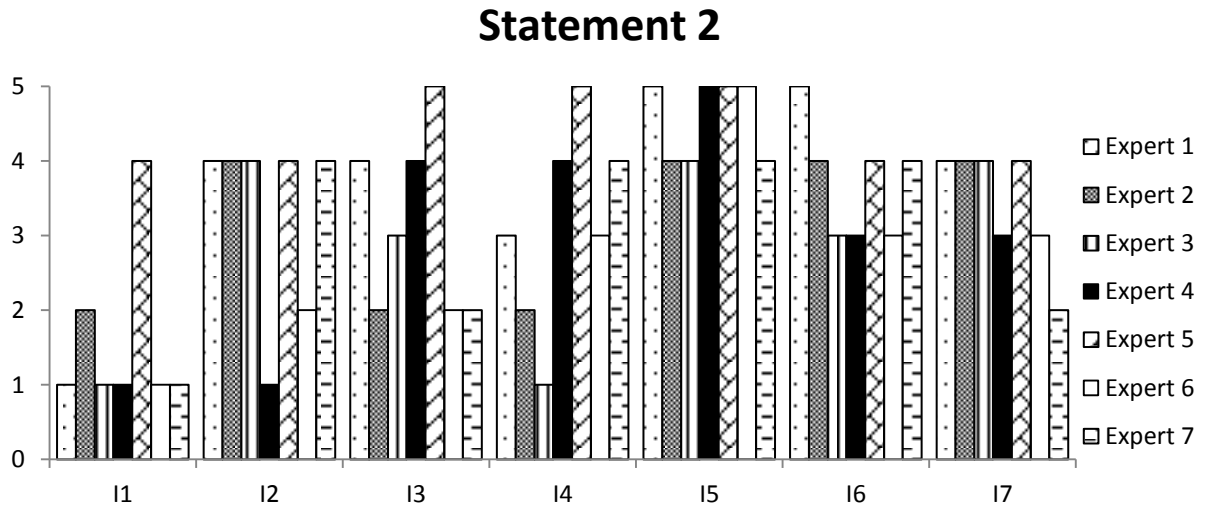
I List of participating actors in the interviews

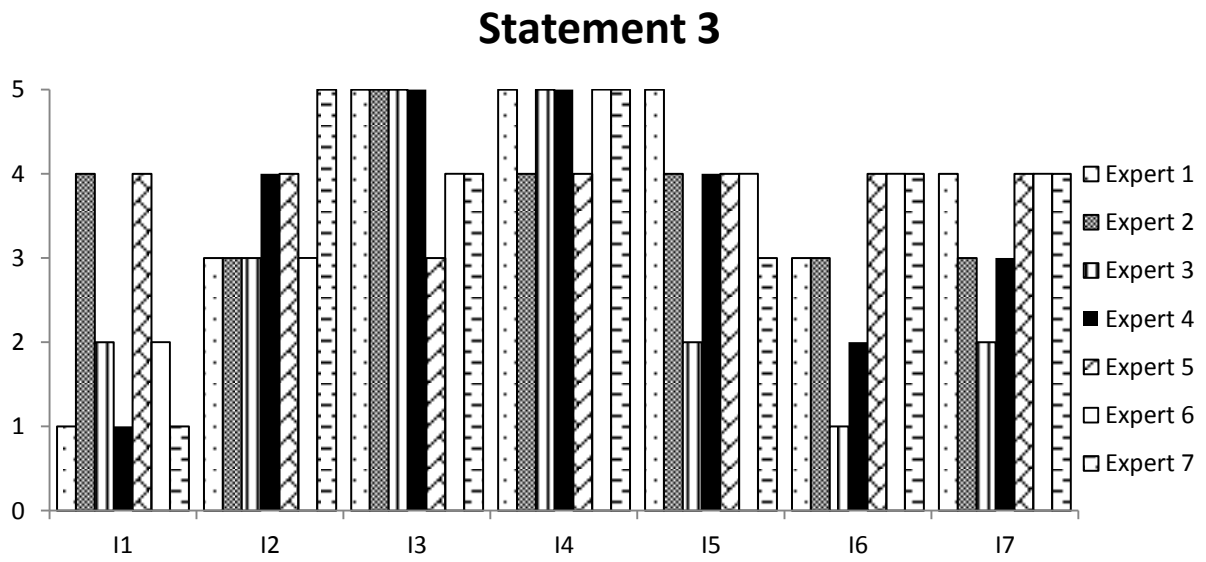
Category	Actor group	Name	Other actor groups
Citizens	Inhabitants	Wietske Wolf	-
		Fam. Van der Zee	-
		Fam. Pompe	-
Nature, Culture and Agricultural NGO's	HWL	Henk Malta	Inhabitant
		Joost Kievit	Inhabitant
	Erfgoedkoepel Hoeksche Waard	Willy Spaan	Inhabitant, Platform Hoeksche Waard
	Natuurmonumenten	Helma Braat	Platform recreation and tourism SOHW
Policy	Municipality Binnenmaas	Natasja Boortman	SOHW/Inhabitant
	Municipality Korendijk	Jaap Groeneweg	SOHW/Inhabitant
	Municipality Strijen	Jaap Klok	SOHW/Inhabitant
	SOHW	Gerard Leggedoor	Inhabitant
Agriculture	Farmers	Biostee (organic)	Inhabitant[a]
		Loonbedrijf Breure (conventional)	H-Wodka/inhabitant[a]
	LTO	Joke de Geus	Farmer/inhabitant
Tourism en Recreation	VVV (regio coordinator)	Tjerd Kamphuis	Platform recreation and tourism SOHW
	Recreatieoord Binnenmaas	Anne Knoot	Farm background/inhabitant
Foundations landscape Hoeksche Waard	Wildbeheereenheid Hoeksche Waard	H.J. Flieringa	H-Wodka/alderman municipality Cromstrijen/inhabitant
	Stichting Rietgors	Janneke Zevenbergen	Farmer/inhabitant - used to be an alderman in HW and worked on spatial planning
	H-Wodka	Aad Klompe	Farmer/inhabitant[a]
		Peter Lerink	Entrepreneur/inhabitant/soil scientist
Other	HW wonen	Ben Pluimer	Hoeksche Waard duurzaam

[a] Farmers might be members of LTO as well

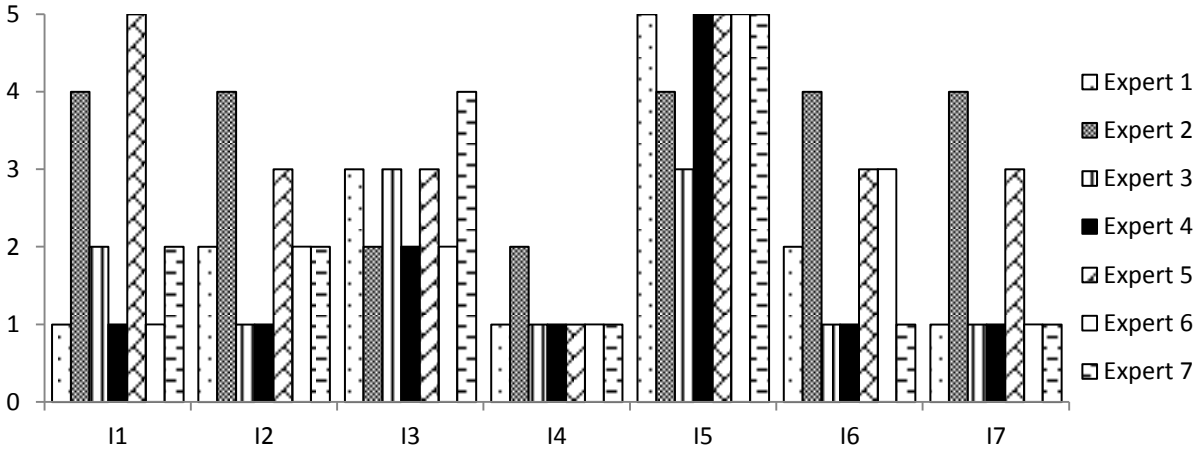
II Link objectives and indicators using MCDM



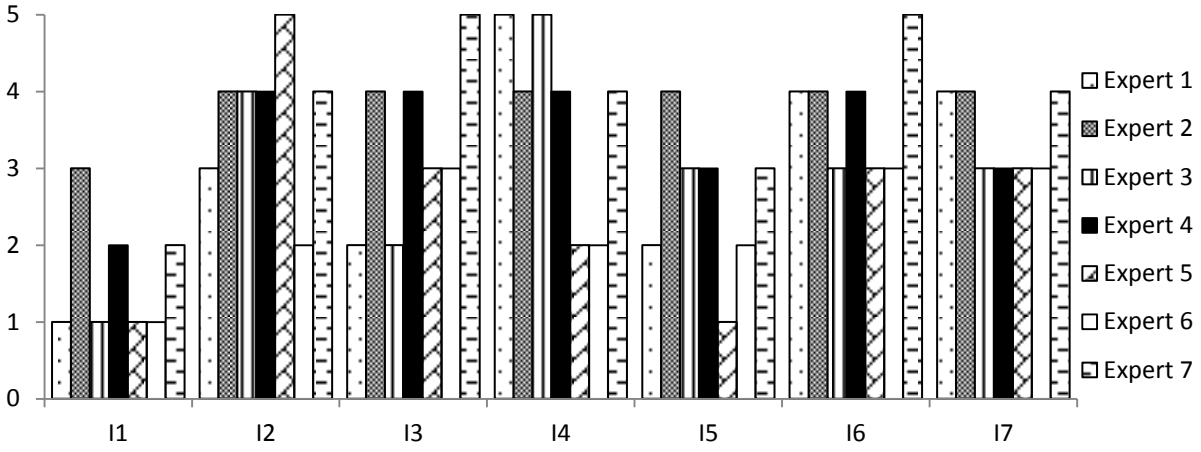




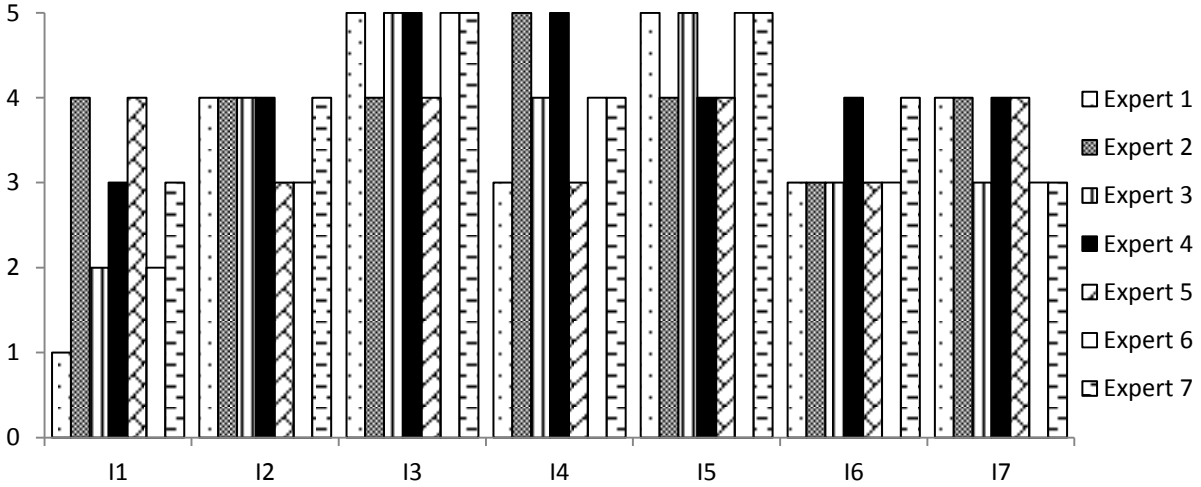
Statement 4



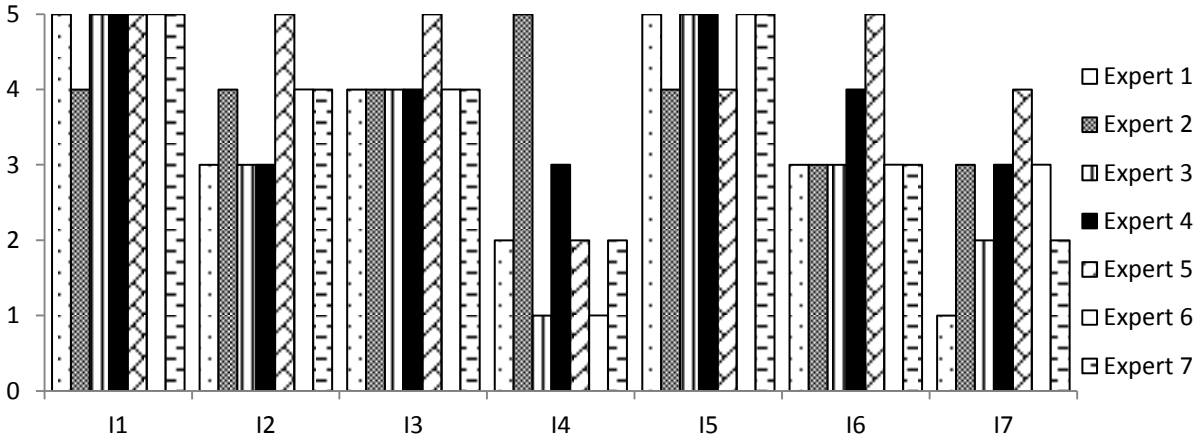
Statement 5



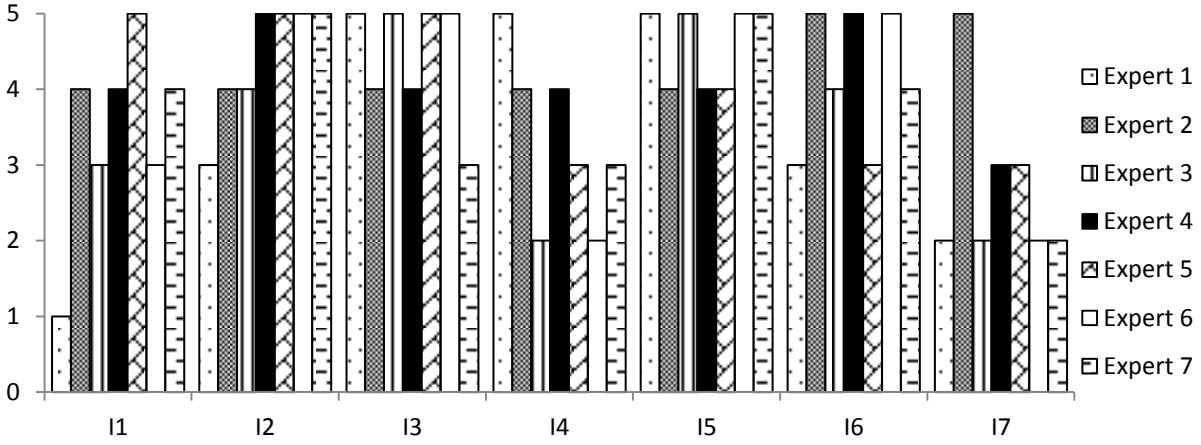
Statement 6



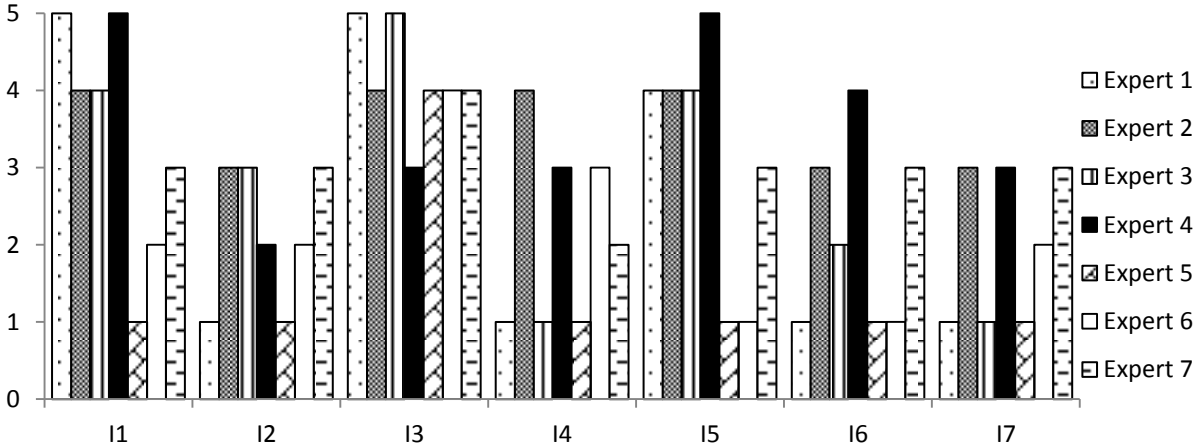
Statement 7



Statement 8



Statement 9



III Basic set of interview Questions

- What characterises the Hoeksche Waard for you?
- What do you consider important aspects within the landscape?
- Which important functions does the landscape provide you?
- What do you appreciate most in the current landscape? And what aspects could be improved?
- What aspects of the Hoeksche Waard are of your concern?
- How would you describe your 'ideal' landscape?
- Thinking about the landscape, where do you see economic values?
- How would you express the landscape from a social point of view?
- How would you describe the landscape from an ecological point of view?